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Walden University

COLLEGE OF SOCIAL AND BEHAVIORAL SCIENCES

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Alycia Harris

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2009

ABSTRACT

Social Construction of Knowledge in a Semiformal, Long-Term Learning Environment:
A Qualitative Study

by

Alycia Harris

M.S., Walden University, 2006
B.S., Charter Oak State College, 2000

Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
Psychology

Walden University
May 2009

ABSTRACT

Social learning plays a critical role in cognitive apprenticeship, community of practice, and knowledge production theories. Gunawardena's interaction analysis model, which provides a means of evaluating discourse for social construction of knowledge, is comprised of five phases: (a) sharing and comparing, (b) disagreement, (c) negotiation and co-construction of new knowledge, (d) testing of new knowledge, and (e) use or phrasing of new knowledge. There is a paucity of research that has empirically explored social construction of knowledge, especially in an extended semiformal asynchronous graduate learning experience. This study explored two research questions: whether social construction of knowledge took place, and if so, how such construction occurred. The study used data from two quarters of a five-quarter graduate level, asynchronous research laboratory allowing students in psychology programs to work on a faculty research project. This study was a qualitative secondary data analysis of 1,739 postings by 17 students and one instructor. The original transcripts were converted to a database for coding using the interaction analysis model. Numerous uses of phase II, disagreement, and above demonstrated that social construction of knowledge occurred and provided a method of understanding how such construction took place. Students socially constructed knowledge by expressing disagreement or dissonance and then worked together to synthesize new knowledge. As a critical component of situated learning, understanding social construction of knowledge provides impetus for pedagogical improvements for increased learning. This in turn can provide students with necessary knowledge and new ideas to apply toward positive social change in their communities.

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DEDICATION

This is dedicated to my husband, Gerry Harris for your ongoing support and willingness to take up the slack while I worked on my education. I am especially grateful for the hours that you read or listened to me read my papers. This is also dedicated to my grandparents, Cleo and Irene Rusch. You pushed me to strive towards academic excellence and gave me the courage to achieve my academic goals. Thank you for making me learn math. Finally, I dedicate this to my mom, Karyl Martin, for always believing in me; and to my dad, Carl Rusch, who taught me to have dreams and goals.

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CHAPTER 1:

INTRODUCTION TO THE STUDY

Introduction

Several different learning models, such as Wenger's (1998) community of practice and Collins, Brown, and Newman's (1989) cognitive apprenticeship, stressed social construction of meaning and knowledge built on foundational aspects of psychological constructivism (Richardson, 2003). In the constructivist approach, the learner acquires new knowledge that is built on and integrated with past knowledge, interests, and attitudes (Fosnot, 1996; Howe & Berv, 2000; Richardson). This construction of knowledge is not entirely individual as social factors also influence the process (Richardson). The question then becomes how to explore how learners' socially construct knowledge and meaning. Major theoretical frameworks are predicated on social learning. Without a deeper investigation into how learners work together to form knowledge and meaning, social learning remains an assumption. This formed the research problem for current study.

This question is important in the online setting where individuals are at a distance from one another. The expansion of the Internet has spawned an escalation in online education (Johnson & Aragon, 2003), a phenomenon expected to continue (Allen & Seaman, 2004). Researchers have begun to tackle this topic and to create frameworks for the evaluation of social construction of knowledge and meaning (Gunawardena, 1999). This early research provided researchers and educators with the means to expand

understanding about how social construction of knowledge takes place, as opposed to what appears to be a reliance on the notion that social learning simply occurs.

While studies have examined online computer mediated communication for single courses (Moore & Marra, 2005), there is little in terms of longer, less formal but still academic learning situations. From 2004-2005, Walden University, a university where students earn their degree via online education, offered an independent study, situated learning based program that spanned five quarters where students could learn research skills along side a faculty mentor as research assistants. This study sought to conduct a secondary data analysis on the data collected from this five quarter independent study program. The goal of this study was to evaluate social construction of knowledge and meaning through the use of Gunawardena's (1997) model in a semiformal community of practice that lasts longer than the typical courses studied in the current literature. The findings should contribute to the discipline's understanding of how learners work together to socially construct knowledge and meaning in a semiformal environment where there is less pressure from a teacher or facilitator toward such social construction of knowledge and meaning.

Background of the Problem

As online learning continues to grow (Allen & Seaman, 2004), more research is needed to develop effective pedagogy that is appropriate for this environment. Cognitive apprenticeship (Collins et al., 1989) and community of practice (Wenger, 1998) provided foundational models for social learning. While social learning provided the framework

for community of practice (Wenger), cognitive apprenticeship established social learning as a critical part of situated learning. Neither model provided a means of specific analysis of the construction of meaning and knowledge in a social environment. However, Gunawardena (1997) provided an excellent framework, the interaction analysis model, for the examination of social construction of knowledge, validated through subsequent research (Moore & Marra, 2005).

Theoretical Framework

Constructivist learning principles formed the theoretical framework for this study. Several key theories, including cognitive apprenticeship (Collins, Brown, & Newman, 1989) and community of practice (Wenger, 1998); provide the foundation for the exploration of social construction of knowledge. These key theories were all built on constructivist principles. The following sections, starting with a brief discussion of constructivism, introduce these key theories. Additionally, this study is predicated on the idea that argumentation and negotiation is a critical component to social learning (Baker, 2003). In order to adequately evaluate social construction of knowledge, this study required a means of identifying these vital steps. The interaction analysis model developed by Gunawardena et al. (1997) afforded the final piece of the theoretical framework, by providing a theoretical means of identifying critical components of social construction of knowledge. Chapter 2 discusses the theoretical framework in greater depth.

Constructivism

Learning stems from the construction of understanding from past knowledge, attitudes and interests (Fosnot, 1996; Howe & Berv, 2000; Richardson, 2003).

Furthermore, construction of knowledge is influenced by social factors, through cooperation (Richardson). The student's ability to examine his or her own thinking, that is, metacognition is also an important factor in the construction of new knowledge on past knowledge and experience (Watson, 2001) and permits the student to reflect on and apply knowledge in new situations (Cotner et al., 2000; Johnson & Aragon, 2003).

These models all discuss social construction of knowledge and meaning as assumptions of sound pedagogy. This leads to the questions of whether the literature support these assumptions and, how do individuals socially construct knowledge, especially when learning in an online environment.

Community of Practice

Wenger's (1998) model of community of practice integrated five essential components for social learning: (a) community, (b) identity, (c) practice, (d) meaning, and (e) learning. The components work together, while each supports the other (Wenger). A community of practice would not function well if any component was missing (Wenger). However, each component can be central to the functioning of the community (Wenger). For example, a community needs members who then acquire identity through membership, but to build on this identity, the member must learn the practices of the community and come to share and understand the meaning associated with the practices of the community (Wenger).

Learning is not just a mechanical and biological process by the learner (Wenger, 1998). Learning requires meaning and in Wenger's model, meaning in the context of everyday life. In Wenger's model, meaning derives from the process of negotiation and interplay of participation in an activity, with others, and reification, which makes what is experienced in participation concrete.

Cognitive Apprenticeship

Cognitive apprenticeship integrates the traditional instructor-centered classroom, designed to impart domain knowledge, with the notion of situated learning based apprenticeships (Collins et al., 1989). The cognitive apprenticeship model offered a comprehensive outline for situated learning that addresses content, method, sequencing and sociology. The sociology component mirrored Wenger's (1998) community of practice in that learning requires cooperation and collaboration, within an authentic environment (Johnson, 2001), that permits transferability of skills (Williams, 1992). Communication and understanding must work hand-in-hand to develop community as well as a sense of ownership in the process. Such mutual effort is key to motivation for learning (Stepien & Gallagher, 1993) and for discovering (Bruner, 1973). Furthermore, situated learning drives the collaborative process (Stepien & Gallagher) that fosters problem solving and provides resources to the community (Browne, 2003; Johnson, 2001; Johnson & Aragon, 2003). Finally, collaboration provides validation of the construction of meaning (Richardson, 2003).

Interaction Analysis Model

Social construction of knowledge often involves disagreement between the individuals involved (Gunawardena, 1998). Because existing interaction analysis models did not adequately address these disagreements and inconsistencies, Gunawardena et al. (1997) proposed the Interaction Analysis Model to outline the negotiation of knowledge construction when inconsistency is involved, (a) sharing and comparing knowledge, (b) dissonance or dissonance, (c) negotiation and co-construction of new knowledge, (d) testing tentative new knowledge, and (e) application of newly-constructed knowledge (Gunawardena, 1997)

Research on Knowledge Construction

While Moore and Marra's (2005) research involved discussion board postings that used structured guidelines specifically intended to foster argumentation, the researchers found that generally, to foster social construction of knowledge, the objective of asynchronous communication, such as discussion boards, must be clearly understood. A reduction in the requirement to post also decreased extraneous or redundant postings just to meet a requirement, but also reduced participation from the social network toward construction of knowledge. This issue of required postings may be ameliorated by a less formal environment, where the focus is on a project as opposed to a requirement to meet certain learning objectives.

Statement of the Problem

The problem that this study addresses is that major theories for pedagogy place emphasis on, and rely on, social learning (Collins et al., 1989; Wenger, 1998). The literature supported the correlation between situated learning and cooperation (Stepien & Gallagher, 1993) and the value of formation of meaning as an outgrowth of cooperation (Richardson, 2003). There is less literature that provided a solid investigation of how students socially construct knowledge or meaning, especially in semiformal, long term learning environments where there is less direct pressure for social construction of meaning and knowledge.

The Purpose of This Study

This study examined social construction of meaning and knowledge in a situated online learning asynchronous environment that encompasses a longer period of time than the typical one quarter or one semester course. To date, the current literature using the interaction analysis model (Gunawardena et al., 1997) covers online discussion and debate forums covering just a few weeks or a formal, online graduate course covering a single semester (15 weeks). The current study sought to investigate a learning environment over a longer period of time. Additionally, this study examined a learning environment less formal than the typical online classroom, but more formal than a non-academic online community. Gunawardena et al. explored an environment that was less formal than a graduate classroom in that participants were not required to participate but were encouraged through facilitation. The second study discussed by Gunawardena et al.

employed very little facilitation. Moore and Marra's study used a formal classroom with specific participation requirements. The current study used the interaction analysis model (Gunawardena et al.) in a setting that required participation similar to a formal graduate course, but instituted less rigorous participation requirements. The current study expanded the use of the interaction analysis model to a setting not otherwise addressed in previous research and used the interaction analysis model on a setting previously identified as fitting a community of practice and cognitive apprenticeship (Cawthon & Harris, 2008).

Research Questions

The following two research question guided this dissertation: First, does socially constructed meaning and knowledge occur in a long term, semiformal, asynchronous learning environment? Second, if socially constructed knowledge occurs, how does it form in this environment?

To answer these research questions, this dissertation concept conducted a secondary data analysis on the five quarters of communication data already collected as part of the Walden University Lab (lab). These data were valuable because they represented a long-term, online, situated learning event. The available data represented the majority of communication involved in the learning event and provided the necessary answers to the above research questions.

The available data provided the opportunity for a qualitative study with a mixed analysis approach, advocated in similar studies (Gunawardena, 2000; Moore & Marra,

2005). The data were evaluated to determine an appropriate unit of analysis and then coded (Chi, 1997). The coded data were interpreted quantitatively through the use of statistical software and evaluated qualitatively to create a narrative to describe the phenomenon of social construction of knowledge and meaning within this case study.

The lab was intended to model the faculty mentoring process typically found in most traditional environments. In the lab, students became research assistants for a faculty research project, learning the research process in a safe and secure environment. The lab fit well in the cognitive apprenticeship style model developed by Collins et al. (1989). The lab also represented community of practice (Wenger, 1998), intentionally formed as a group-based situated learning environment. The available communication files included discussion board data and synchronous chat room data.

Definition of Terms

Cognitive Apprenticeship: This term represents a learning model that combines traditional apprenticeship, where the apprentice learns a skill from an expert, typically through situated learning. The full model incorporates four main components: (a) content, (b) method, (c) sequencing, and (d) sociology. This study focuses on the sociology component for the most part, but discusses all four components given they are all essential to this model's learning outcome (Collins et al., 1989).

Community of Practice :This term pertains to the social learning model proposed by Wenger (1998) comprised of five interrelated components: (a) community, (b) identity, (c) practice, (d) meaning, and (e) learning. A successful community of practice requires all five components to work interactively (Wenger, 1998). This paper is especially interested in the latter two components.

Situated Learning: Situated learning refers to learning environments that incorporate the reality of what is being learned. An apprenticeship, as well as a cognitive apprenticeship, involves learning with the same context as the actual skills will be used (Collins, 1989). A community of practice involves situated learning in that the new member enters the actual community and learns as he or she develops within that community (Wenger, 1998).

Interaction Analysis Model: This is a model for discourse analysis of social construction of knowledge when it involves inconsistencies or disagreements (Gunawardena, Lowe & Anderson, 1997). This model provides categories that define stages of knowledge development as individuals either agree or choose to disagree with ideas presented to the group. The disagreement process is carried through other steps, which may or may not actually occur in the discussion, showing analysis of attempts to reach consensus and then use the new, agreed upon information.

Long-term: This study defined long term as any period longer than a single quarter. Previous studies examined shorter periods of time from just a few weeks (Gunawardena et al., 1997) to one semester of 15 weeks (Moore and Marra, 2005).

Semi-formal learning: for the purpose of this study, the concept of semi-formal learning refers to a classroom environment where the student is expected to participate, but such participation is not rigidly controlled. The participant in the lab was asked to contribute to reaching the goal of conducting the research project with the faculty member. Interaction was informal in that participants did not have to adhere to American Psychological Association style and conversations were fostered around activities throughout the two quarters. The setting was not as informal as an online chatroom nor as formal as a regular course.

Assumptions and Limitations of the Study

This study involved several assumptions and limitations. The assumptions were divided into those related to theory and those related to method. The last section describes the study's limitations.

Theory

This study is predicated on the assumption that social learning takes place in both a community of practice (Wenger, 1998) and cognitive apprenticeship (Collins et al., 1989). The earlier research on the lab (Cawthon & Harris, in press) indicates that the lab fulfills the description of both of these theoretical models. Therefore, the assumption exists that participants socially constructed knowledge. The model, developed by Gunawardena et al. (1997) is designed to capture how participants in a social learning environment socially construct knowledge. Furthermore, this study and the interaction

analysis model assume that argumentation and negotiation are means of social interaction to form knowledge and meaning (Baker, 2003; Gunawardena et al.).

Method

As a result of the theoretical assumptions, this study assumed the available data would provide evidence of social construction of meaning and knowledge. Additionally, this study assumed that the 24 weeks of data used would be enough to see all of the phases of the interaction analysis model (Gunawardena et al., 1997) and to see if time was a factor. This study also assumed the model proposed by Gunawardena et al. (1997) accurately reflected the social construction of knowledge present in the available data and that coding with this model was possible for the principal investigator and the individual who provided inter-rater reliability and that 95% agreement was achievable. Chapter 3 and Appendix A discuss the selection and training of the researcher and provide inter-rater reliability in detail.

Limitations

This study was limited to the data already collected. Furthermore, because the study was a case study, generalizability of the findings was limited to the setting and situation under study (Creswell, 2003). Finally, the principal investigator was a member of the community of practice, the classroom, for four of the five quarters and participated in the initial research project and data collection from which the current study was drawn. Because of the intimacy with the data and the original experience and the intent by which the principal investigator entered into the lab, there existed the potential for researcher

bias in regards to the presence of social construction of knowledge and for interpretation of other participant's discussion and chats in terms of social construction of knowledge. The individual who provided inter-rater reliability was able to provide some protection against bias by the principal investigator.

Significance of the Study

This study validated and advanced understanding of when and how knowledge construction occurs in an online environment. The study added to the settings for which the literature explores social construction of knowledge. Additionally, the study validates the presence of social construction of knowledge in a setting designed to be a cognitive apprenticeship and community of practice since both of these models rely on social construction of knowledge (Collins et al., 1989; Wenger, 1998). Because of the source of the data, the study was able to also contribute to the emerging body of knowledge in regards to research training environments for online students, which provided these students with opportunities to work with faculty mentors (Cawthon, Harris, & Jones, under review). The findings also contributed to an overall understanding of long term apprenticeship style learning environments. While the findings were not necessarily generalizable, they provided another piece of the puzzle in understanding the growing online learning environment.

Social Change Implications

As online education grows (Allen & Seaman, 2004), so does the need to strengthen online education programs (Hiltz & Turoff, 2005). Huang (2002) suggested that the online environment is the perfect place for the constructivist learning, which

requires learners to interact together to form new understanding and knowledge (Richardson, 2003). Furthermore, pedagogical theories such as cognitive apprenticeship (Collins et al., 1989) and community of practice (Wenger, 1998) place such emphasis on social learning, and more importantly social construction of knowledge. It is through strong learning events learners acquire the necessary knowledge and skills they can later put to work in subsequent activities (Collins, et al., 1989).

The setting for this study was designed to allow graduate students to gain familiarity and comfort with research (Cawthon & Harris, 2008). To be able to understand social construction of knowledge has social change implications in that it can help foster stronger research programs that in turn develop researchers who desire to do more research that contributes to their disciplines and their communities. An earlier study showed that involvement in the setting did promote interest in doing research (Cawthon & Harris). This current study provided some insight into how students socially constructed knowledge, improving understanding about how such settings can be effective platforms for launching knowledgeable researchers.

Summary and Introduction to Subsequent Chapters

Social construction of knowledge and meaning is a critical component of the theoretical models like cognitive apprenticeship (Collins et al., 1989) and community of practice (Wenger, 1998), as well as the underlying theoretical model of constructivism (Richardson, 2003). Less literature existed that supported how such social construction of knowledge takes place. The interaction analysis model proposed by Gunawardena et al.

(1997) provided a validated (Moore & Marra, 2005) approach for the exploration of the question of how social construction of knowledge and meaning takes place.

Chapter 2 provides a deeper analysis of the related literature. The first part of chapter 2 gives a thorough review of the literature related to the setting of the lab and the context, research training environments. The review of the literature discusses constructivism and establishes constructivism as the foundation for the two major theoretical frameworks that drove the need for the study of social construction of knowledge, cognitive apprenticeship (Collins et al., 1989) and community of practice (Wenger, 1998). The literature review explains why the interaction analysis model was the best model for the investigation of the phenomenon of social construction of knowledge, as well as other research that uses the interaction analysis model.

Chapter 3 presents the research design, and describes how this study stemmed from earlier, broader research on the lab. Chapter 3 presents the rationale for a secondary data analysis and describes the research design and procedures in depth, which includes discussion of a pilot that used the first quarter data and the issues that emerged from the pilot study. Chapter 4 presents an analysis of the data and shows how the data answered the research questions. Chapter 5 integrates the data with the literature and discusses the findings in greater depth. Chapter 5 also discusses how this study contributed to the literature in terms of social change and where more research is needed.

CHAPTER 2:

LITERATURE REVIEW

The two research questions for this study was to first to explore whether social construction of knowledge occurs in a semi-formal, long term, online asynchronous learning environment; and second to examine how individuals socially construct knowledge in this setting. In order to examine these research questions, it was important to examine the literature in several different critical areas. The first half of this chapter discusses the impetus for the research, the setting, and the theoretical models driving the research. The second half focuses on the components involved in better understanding the research questions, which includes computer-mediated communication and the best model to evaluate social construction of knowledge in discourse.

Search Strategies

An earlier study conducted with Walden faculty and the thesis completed by me, provided literature for the foundational theories and setting. For those earlier studies, the literature was searched by key words for each major theme. For example, for literature related to graduate student learning, the literature was searched with terms such as *adult pedagogy*, *andragogy* (pedagogical theory extended to address adults separate from children), and *adult learning*. For literature related to the setting the following types of terms were used: *online learning*, *online pedagogy*, and *elearning*. Because the original study explored the lab as a research training environment, the term *research training environment* was also searched, along with *case-based learning*, *project-based learning*,

and *situated learning*. These terms, along with the terms related to adult learning, produced literature related to the key theoretical framework that drove the earlier studies: *constructivism* and *cognitive apprenticeship*.

Cognitive apprenticeship is based on situated learning and constructivist pedagogy. Literature found through these searches provided themes related to and within these frameworks, which provided further ideas to research in the literature. These included terms such as *collaborative learning* and *social learning*, as well as more complex ways to view constructivism, such as *social constructivism* and *psychological constructivism*.

Subsequent research on literature related to social aspects of learning showed a connection to *community of practice*. A review of community of practice as a theoretical model of socially based learning yielded numerous connections to the fundamental components of cognitive apprenticeship and its foundation, constructivism. This in turn produced the research questions that drove the current study.

In order to examine the current study, further themes needed to be investigated in the literature. It was necessary to examine communication within the online setting and initial searches used terms such as *computer mediated communication* and *online learning+ communication*. It was also necessary to explore how the literature treated social construction of knowledge or meaning as well as how researchers actually studied these concepts. Some of the search terms used included *social construction of knowledge*, *social formation of knowledge*, *social construction of meaning*, and *collaborative learning*. In order to examine how these constructs were studied by other researchers, the

literature was searched for *discourse analysis*, which yielded the term *interaction analysis* that produced the model used in the current study.

The majority of searches used the following EBSCO databases: Academic Search Premier, ERIC, Education Research Complete, PsycARTICLES, PsycINFO, and SocINDEX. Other searches were conducted on the JSTOR database available to the principle investigator through California State University Dominguez Hills, the Sage Publications database through a free trial, and Google Scholar. Several key books were purchased and articles unavailable online were requested through interlibrary loan.

These searches yielded a large amount of literature for each of the key themes. However, each of these studies yielded valuable literature used to support those studies or to provide contradictory views. Whenever possible, additional literature was procured based on discussions in literature originally found in searches described above. This was especially true for Gunawardena et al.'s (1997) Interaction Analysis Model.

The Current Study

This review of the literature begins with an examination of research related to the impetus for the original study of the lab, research training environments. The current study stems from that earlier research that sought to expand understanding of research training environments for online graduate students of psychology (Cawthon & Harris, in press). Because this research involved an online setting, one that is different from the traditional classroom, it was also necessary to examine the state of online learning. The review then transitions to the foundational pedagogical theory, the theory of

constructivism, which set the stage for the theoretical models that drove the research questions. This set the stage, for the introduction of the theoretical models for which social construction of knowledge and meaning plays a central role. These were cognitive apprenticeship (Collins et al., 1989), community of practice (Wenger, 1998), and knowledge production (Scardamalia & Bereiter, 1994).

At this point, the paper explores how students socially construct learning or meaning in an online environment. The second half of the chapter delves into these components in detail. For example, in order to examine student communication it was important to understand what kinds of communication take place in online learning environments. After an exploration of computer mediated communication, the literature review discusses how online communication has been studied and whether these previous approaches provided an adequate approach to the current research questions. The review revealed that the interaction analysis model proposed by Gunawardena et al. (1997) was the best approach to discourse analysis needed to understand social construction of knowledge or meaning. The literature review discusses other research that used the proposed model. The chapter concludes with a discussion of the previous research, which had not yet addressed social construction of knowledge or meaning in an online context that is semi formal and conducted over a much longer period of time than the typical one quarter or one semester class. This discussion sets the stage for the importance of the current study.

Research Training Environments

The current study stemmed from earlier work that sought to explore the role of learning about research in an online setting (Cawthon & Harris, In press). Initial forays into research training involved introductory courses with little attempt to make research relevant (Gelso, 1993). These learning opportunities are instructor-based and lack real world application. The negative impact of these early experiences (Gelso) often extended to the first opportunity some students have to experience research in an actual setting, the thesis or dissertation process required for graduation (Krumboltz, 2002).

Gelso (1993) advocated exposure to real research early in a student's career. This research should be nonthreatening (Krumboltz, 2002; Shivy, Worthing, Wallis, & Hogan, 2003) and help make obvious the real issues and drawbacks inherent in all research (Gelso). The student needs to understand that all research has limitations but can still be an important contribution to the discipline. As students begin to experience the enjoyment of research and gain skill and comfort with the procedures involved, the students will begin to consider how to apply their education experiences to their own interests (Gelso).

The literature supported the importance of research prior to theses and dissertations. Students often seek out these experiences in traditional settings on their own, preferring to experience research mentored under the relative safety of a professional prior to the need to tackle research more on their own (Cotner, Intrator, Kelemen, & Sato, 2000). Other institutions have made research experiences in this protected manner a requirement. Rosemead, the School of Psychology, at Biola

University in California instituted apprenticeship-style research opportunities that reveal an increased interest in research after graduation (Hill, Hall, & Pike, 2004). Walden's lab was provided as an elective opportunity for students to participate in research along side a member of the faculty. The first study showed that the research experience fits a cognitive apprenticeship, like that proposed by Collins et al. (1989). The cognitive apprenticeship model is discussed in greater detail below. Participants in the lab self-reported increased knowledge and interest in research (Cawthon & Harris, 2008; Cawthon, Harris & Jones, in review). The initial study did not explore how participants learned in a social setting.

The current study sought to explore specific learning obtained within a social environment that was used in this setting to learn about research. The focus of this current study was not so much how the participants learned about research, but how those participants may or may not have socially constructed meaning and knowledge. As stated, the first study indicated that participants perceived the five-quarter learning experience to be successful as measured by student perception (Cawthon & Harris, In press). As described, that experience was predicated on constructivist learning.

Online Learning

The Sloan-C organization indicated online learning is where at least 80% of the content is online (Allen & Seaman, 2004). As the Internet continues to grow, online education continues to grow as well (Johnson & Aragon, 2003), a phenomenon expected

to continue at a significant rate (Allen & Seaman). As of 2004, 90% of post-secondary institutions offered at least some programs online (Allen & Seaman).

The growth of online education has spurred a demand for institutions to evaluate how to expand programs online (Hiltz & Turoff, 2005) and make the best use of the environment (Grabinger & Dunlap, 2002). This trend was part of the impetus for the first study and helps drive the rationale for the current study that seeks to understand social construction of knowledge in an online learning environment.

Researchers advocated the constructivist approach for online learning (Grabinger & Dunlap, 2002; Huang, 2002). The online environment provides an ideal setting for self-direction, a critical component of constructivism together with a broad range of available resources (Huang).

Theoretical Framework

Two key theories formed the theoretical framework used for the current study. Cognitive apprenticeship, a form of situated learning, provides a comprehensive pedagogical model involving content, method, sequencing, and sociology; that allows novice students to work together with an expert to develop new knowledge (Collins et al., 1989). Community of practice integrates community, learning, and practice in the formation of meaning and new identity within the community. Both of these theories are based on constructivist learning principles.

Constructivism

Constructivism maintained that in order to produce new knowledge, the learner builds on what he or she brings to the learning experience in terms of prior knowledge,

interests, and attitudes (Fosnot, 1996; Howe & Berv, 2000; Richardson, 2003). A constructivist learning environment must allow for these various facets, brought by the student, to interact meaningfully with the information imparted in the learning event (Howe & Berv; Richardson).

A critical component of psychological constructivism is the social influences involved when learners interact with one another to form understanding and knowledge (Richardson, 2003). Vygotsky (1978) maintained that the potential development level of a child is that point at which a child can solve a problem with collaboration from a more knowledgeable child or the teacher, which he or she could not have solved alone. The difference between the potential development and actual development is Vygotsky's zone of proximal development. Meaning is derived and agreed upon through cooperation (Richardson). Cooperation drives the construction of meaning by a group of the phenomena it encounters. Indeed, Vygotsky posited that it is a social nature, where children develop intellectually within the social environment that sets human beings apart from animals. This notion was a major component of the pedagogical models discussed below: cognitive apprenticeship (Collins et al., 1989) and community of practice (Wenger, 1998).

The emphasis in the constructivist learning environment provides opportunities for collaborative development of meaning. However, this process requires students to be aware of their own thinking, called metacognition. To measure metacognition is a challenge because it requires thinking to be visible (Conner & Gunstone, 2004), another fundamental component of cognitive apprenticeship, as described below. Metacognition

allows the student to integrate new knowledge with old knowledge and to learn in a self-directed manner.

Richardson's (2003) discussion of constructivism set the stage for the development of both cognitive apprenticeship (Collins et al., 1989) and community of practice (Wenger, 1998). It also provided the theoretical foundation that drove the current study. This study sought to examine how that might take place in an online setting.

Cognitive Apprenticeship

The initial study of the lab was conducted within the theoretical framework developed by Collins, et al. (1989) known as cognitive apprenticeship. Cognitive apprenticeship is actually a project-based, situated learning environment centered on a real-life practical application. As previously mentioned, the cognitive apprenticeship model clearly mirrors the fundamental components of constructivism (Fosnot, 1996; Howe & Berv, 2000; Richardson, 2003) and metacognition (Conner & Gunstone, 2004).

The goal of cognitive apprenticeship is to marry traditional instructor centered classroom environments with the apprenticeships typified in by an apprentice learning alongside of an expert in performance of the actual functions necessary to achieve this apprenticed skill (Collins et al., 1989). The expert, the instructor, must make his or her thinking visible (Collins et al.), which requires strong metacognitive skills as described above (Conner & Gunstone, 2004) and assist the learner to recognize his or her own thinking and how to make that thinking visible (Collins et al.). This then requires the student to have or develop metacognitive skills, a critical component of expertise. The

cognitive and metacognitive process in cognitive apprenticeship may be further challenged by the vagueness of context, as opposed to a traditional setting where the context is more likely to be obvious.

The cognitive apprenticeship model consists of four integrated components: (a) content, (b) method, (c) sequencing, and (d) sociology (Collins et al. 1989). As revealed in earlier research (Cawthon & Harris, 2008), the lab evidenced at least three of these components (method, content, and sociology). An example of method was instructor-modeled demonstrations of how to run statistical analyses. Examples of content included knowledge of how to code data collected from the survey as well as knowledge of assessments for students that are deaf and hard-of-hearing. Examples of sociology were the use of collaborative language and language that showed feelings of co-ownership in the research process and, critical to this study, demonstrations of social construction of meaning. Sequencing was not examined in earlier studies. However, the instructor indicated a plan to transition from the large picture to more focused pieces of the picture (Collins et al.). The principle investigator of the current study was also a participant and can attest to appropriate sequencing over the life of the apprenticeship.

Content. Content includes (a) domain knowledge, (b) heuristic strategies, (c) control strategies, and (d) learning strategies (Collins et al., 1989). Domain knowledge provides the facts and figures usually associated with a classroom environment. Heuristics include the tricks of the trade and enables the instructor to bring his or her experience to the learning environment and provide the student with ideas to tackle true to life situations. This is also the opportunity for students to construct knowledge that

builds on past experiences and the domain knowledge (Darabi, 2005). Now the learner has a greater variety of tools from which he or she must choose the best solution, control strategies, for the problem at hand. The student uses learning strategies to incorporate the domain and heuristic knowledge. It is important to note that to be successful, the content component requires participation from both instructor that provides domain and heuristic knowledge, and the learner that provides control and learning strategies (Collins et al., 1989).

Method. Like content, method includes several subcomponents that involve both the instructor and the learner (Collins et al., 1989). The instructor must provide the critical components of: (a) modeling, (b) coaching, and (c) scaffolding (Collins et al., 1989). The student must provide (a) articulation, (b) reflection, and (c) exploration. In order to model behavior or a skill, the instructor, the expert, performs the task or skill, demonstrates how it should be done. Studies have shown how much learners value the modeling process (Shivy et al., 2003). It is at this point the instructor can offer metacognitive opportunities to help learners begin to think about their own thinking (Stepien & Gallagher, 1993). It is important for learners to be able to imitate the modeled behavior rather than just observe (Johnson & Aragon, 2003). This provides fertile ground for the instructor to observe and coach the learner and to begin to provide more challenging tasks, scaffolded by other learners or by the instructor (Collins et al.). Scaffolding is an essential part that permits learners, commensurate with constructivist pedagogy (Fosnot, 1996; Howe & Berv, 2000; Richardson, 2003), to draw on their

current knowledge to new knowledge and yet receive assistance as needed (Collins et al.).

The learner is then able to display that he or she understands the task through articulation, which may take many different forms such as discussions and group projects, in an online environment (Hiltz & Turoff, 2005). The student then engages in reflection and compares what he or she has learned against what others say (Collins et al., 1989) also highly reflective of constructivist pedagogy (Fosnot, 1996). Reflection, defined in cognitive apprenticeship, begins to merge with the notion of social construction of knowledge. Once the learner begins to feel comfortable with the tasks and material, he or she will begin to require less support and begin to consider other ways to apply the learning, perhaps to his or her own interests (Collins et al.). This ability to transfer knowledge across different situations is critical to the learning process (Grabinger & Dunlap, 2002).

Sequencing. Sequencing permits the expert to perform three critical functions in cognitive apprenticeship: (a) decrease generalities, (b) increase complexity, and (c) increase diversity. The expert introduces the skill as a big picture, with a gradual decrease of these generalities until the learner can comprehend the component parts (Collins et al., 1989). A learner should always have meaningful and relevant tasks from the start (Levin, 2002). At the same time, as the learner begins to understand each component part, he or she should be gradually provided with more and more complexity (Collins et al.). In true constructivist fashion, as the tasks become more specific and more complex, the learner

should be able to pull from a greater diversity of knowledge and skills he or she can use to tackle new tasks.

Sociology. The sociology component addresses the social component of learning. This extends to motivation as well as the setting, both critical to cognitive apprenticeship (Collins et al., 1989) and constructivism (Richardson, 2003). The sociology components consists of (a) situated learning, (b) community of practice, (c) intrinsic motivation, and (d) exploitation of cooperation (Collins et al., 1991). Situated learning provides an essential authentic environment for the learning process (Johnson, 2001) and opportunities to gain skill in the transference of knowledge (Williams, 1992). From a cognitive apprenticeship perspective, community of practice develops along with learner expertise (Collins et al., 1991). This process leads to greater levels of learner ownership in the skill (Collins et al., 1991), which in turn increases motivation to learn more (Stepien & Gallagher, 1993). Intrinsic motivation gives the learner momentum to discover, as opposed to just learn (Bruner 1973) and accounts for the learner's need to draw on personal interests (1966), another critical component of constructivism (Fosnot, 1996; Howe & Berv, 2000; Richardson, 2003).

Situated learning drives cooperation (Stepien & Gallagher, 1993). The cognitive apprenticeship model requires problem solving within a collaborative, cooperative environment, as with the act of reflection as discussed above (Collins et al., 1991). Cooperation drives and validates the formation of meaning as the group encounters new things (Richardson, 2003). As the learner engages in the collaborative effort and gains more skill, he or she also begins to develop an identity with the group, an essential

component in transfer of knowledge to real word issues (Ryba et al., 2002). This development of identity is very similar to the trajectory of membership in Wenger's community of practice.

Community of Practice

The cognitive apprenticeship model has many similarities with Wenger's (1998) community of practice model. While the cognitive apprenticeship model includes a social element, the social element is one of four necessary components without emphasis on any one of the four over the other. In sociology, the social component of cognitive apprenticeship is separate from the method or content (Collins et al., 1989). The community of practice model integrates these components differently.

Wenger's (1998) model involves five interchangeable components: (a) community, (b) identity, (c) practice, (d) meaning, and (e) learning. A community of practice cannot work without all five of these components. Each of the components is interrelated and any component can be central (Wenger). For example, development of meaning requires a sense of identity and membership in the community as the member learns the community's practice (Wenger).

Community. The definition of community is any collection of individuals with social identity and support (Wellman, 2005). As individuals share common practices such as ritual and share the social interaction inherent in communities, the community forms (Wenger, 1998). Membership in the community will involve those who adhere to the norms of the community and work on community goals, as well as those who do not

work against the community or its members (Jackson, Colquitt, & Wesson, 2006). New members have to discover whom they can trust (Hertzog, 2000). If new members fail to connect with current members, new members will not learn the practices or gain meaning and identity (Bathmaker & Avis, 2005). As the Internet grows, so do the number of communities online and more and more the definition of community to expand to include this burgeoning setting (Wellman, 2005).

Identity. As the member learns the practices of his or her community, he or she develops a progressively stronger identity as a member of that community (Lave & Wenger, 1991; Wenger, 1998). The formation of identity requires practice as a member as opposed to just learning for its own sake (Bleakley, 2002). Identity does not just form along one linear path. Instead it progresses along a number of trajectories that include those which cross boundaries between communities and those that lead out of membership in a community (Wenger). Identity is formed collaboratively through interaction with other members, who may represent many different stages of learning and membership (Bradley, 2004; Wenger). This may mean some members seek to imitate members they have a high regard for (Bleakely) and distance themselves from those for which they do not have a high regard (Bathmaker & Avis, 2005).

Practice. To practice is to engage in an activity that may be explicit or inferred (Wenger, 1998). Practice includes not just a common skill, but may include individual skills specific to members, such as in workplace communities of practice, and will include theory. Practice is therefore the activity to be learned through situated learning and includes the domain and heuristic data discussed by Collins et al. (1989). As learners

engage in and learn the activity together, they gain skill and identity both as members of that community and as practitioners of the practice.

Learning. Learning is not a passive part of community membership, but actually serves to mold the community (Wenger, 1998). Over time, members learn the practices. The members sometimes start with just parts of the practice before they attempt entire aspects of the community's practices (Merriam et al., 2003). The learning process is reminiscent of the sequencing component in cognitive apprenticeship (Collins et al., 1989). Learning in a community of practice, similar to constructivism (Fosnot, 1996) builds on previous experience and knowledge (Bradely, 2004).

Meaning. Wenger (1998) stressed that meaningful learning is essential to a meaningful life. This fits well with the supposition by Collins et al. (1989) that learning is best when it is meaningful to the learner. In this broader context, social formation of meaning extends beyond learning. However, this relationship, exhibited by both models and constructivism, emphasized the connection between social formation of meaning and learning, includes social learning and social construction of knowledge (Collins et al., 1989; Wenger, 1998). Therefore, the current study, though focused on the identification of concrete examples of socially constructed knowledge, recognized that this focus is entwined in a broader social construction of meaning. For this reason, the terms have been used interchangeably. Through this intermingled idea of knowledge and meaning, a group determines its own definitions and understanding within its community (Collins et al., 1989). The negotiation of meaning can occur in both expert-to-novice relationships

and interactions as well as in novice-to-novice relationships and interactions (Hertzog, 2000)

Summary of the Two Models

Both of these models rely on the importance of social interaction, collaboration, and community for the formation of learning. The cognitive apprenticeship model integrates social construction of knowledge as part of its sociology components (Collins et al. 1989) while the community of practice model includes social construction of knowledge as a integration of its meaning and learning components (Wenger, 1998). Furthermore, each of these models' components is entwined so that social construction of knowledge requires each component. For example, while it fits in sociology in cognitive apprenticeship (Collins et al.), it requires method, content and sequence to be fully realized. The question then becomes, how do learners, participants in each of these models, construct knowledge socially. This means, the learner does not form his or her own understanding or knowledge independently. He or she constructs that understanding or knowledge with other learners. Those learners may be at different points in the learning process as well as at different points along the trajectory of membership in the community of practice (Wenger).

Knowledge Production: A Related Theory

Scardamalia and Bereiter (1994) emphasized the need for discourse in learning to be patterned on the real-world and to integrate understanding across different forms of

communication and audiences. Knowledge production requires (a) intentional learning, (b) progressively more challenging problem solving, and (c) second order learning environments where learners raise the bar for other learners through accomplishment. The knowledge production approach requires that learning involve, not just formal knowledge, but the informal or tacit knowledge the learner brings to the learning event. The overall focus on knowledge building is on social construction of new knowledge over participant learning of processes and practices (Sing & Khine, 2006).

Scardamalia and Bereiter (1994) proposed that learning should be problem based. The problem drives the need to explore the underlying issues and how these issues relate. This can later be useful in different contextual applications. Learning must also be oriented toward the collaborative rather than individual. It is important the more knowledgeable participate and contribute alongside the less knowledgeable, who, Scardamalia and Bereiter indicated, has as much to offer the learning process. Each participant contributes a different perspective to the group.

Scardamalia and Bereiter (1994) emphasized the value of technology to aid in knowledge production. While computer mediate communication will be discussed in greater depth below, the technology available in the online environment provides a number of ways to encourage collaborative knowledge production. For example, asynchronicity offers learners the opportunity to interact at any time from any place (Scardamalia and Bereiter).

Theory, Setting, and Social Construction of Knowledge

As seen in the first study of the five quarter research lab, participants entered into this apprenticeship or community of practice with different backgrounds both in regards to the subject of the research and in regards to the level of experience in the conduct of research. Students indicated a sense of community, and the first study clearly showed that the lab fulfilled the function of the cognitive apprenticeship, although that study only covered the first quarter of the five-quarter lab. So, if the current study is a community of practice, a cognitive apprenticeship, or an environment for knowledge production, then there should be evidence of social construction of knowledge, a construct critical to these theoretical models.

Computer Mediated Communication

Scardamalia and Bereiter (1994) pointed out that technology provides the same benefits of both written and spoken discourse. Even a number of years ago technology provided an impressive opportunity for education. Computer mediated communication offers (a) time for reflection, (b) a publication and review process similar to what is encountered in the scientific community, (c) the ability to capture communication as a cumulative event, and (d) the opportunity for learners to think independently as opposed to a focus on a few vocal participants (Scardamalia and Bereiter).

Computer mediated communication can represent different, but important, types of learning. Daniel, Schwier, and Ross (2007) found that discourse represented two different types of learning in virtual learning communities: intentional, more formal

learning, and incidental, less formal. Daniel et al. maintained that informal discourse is an essential component to the overall learning process. The informal discourse is where learners can extend beyond the course to build community (Daniel et al.). Informal discourse was evident, and even fostered by the instructor/principle investigator in the lab (Cawthon & Harris, 2008). As Daniel et al. pointed out, the formal and informal learning discourses are often entwined. Socially linked individuals may be encouraged to interact more often (Daniel et al.), perhaps to ask questions or to interact in social construction of knowledge.

The computer mediated communication tools available for the current study include asynchronous discussion board data for five quarters and synchronous chats from all five quarters. Synchronous chats have been shown to offer learners a positive, synchronous place to actively interact and learn (Larkin & Belson, 2005). Asynchronous discussion boards were originally bulletin board forums that have become the backbone of classroom software, like Blackboard and e-College (Gill, 2006), the two classroom software types used over the five quarters of the lab. Gill indicated that discussion boards offer a tool for interaction among learners, as long as the instructor fosters a collaborative environment.

To Understand Social Learning in an Online Setting

The previous section has discussed the setting and the pedagogical theories used to first approach the lab, the setting for the current study. The next section explores how online education is evaluated and specifically how this evaluation might be used for

analysis of social learning. This section outlines several ways researchers approach online learning, especially from a qualitative point of view. However, these approaches do not specifically address social construction of knowledge. Gunawardena et al. (1997), on the other hand, offer a viable model for direct analysis of social interaction that uses discourse analysis of the computer mediated communication transcripts available from the lab. This section offers a thorough examination of Gunawardena et al.'s model as well as a look at some subsequent research that used the model.

Evaluation of Learning, Social Learning and Interaction

It may be difficult to determine the cognitive learning in the online environment. Grades may not be an effective measure (Rovai & Barnum, 2003). In the setting for this study, no grades beyond pass or fail were given. On the other hand, student perceptions of learning are considered a reliable measure (Rovai & Barnum). Earlier studies showed positive learning outcomes both from interviews and from the Rovai (2002) classroom community scale (Cawthon & Harris, 2008). What the earlier studies did not reveal was the relationship between student interaction and perceptions of effectiveness, a relationship critical to the constructivist approach (Rovai & Barnum). Rovai and Barnum found perceptions of acquisition of learning were highest for students who made a lot of postings. What is not addressed is how learning may have taken place within postings or if these postings represented interactions or just responses.

Wang, Sierra, and Folger (2003) examined the development of an online learning community with adult learners. Wang et al. sought to explore whether a community can

form an online setting and whether culture and gender played a role in the development of online community. The researchers emphasize negotiation, which includes attempts to reach agreement and argumentation, efforts to press one's opinions on another. Wang et al.'s discussion of negotiation is reminiscent of an aspect of the sociology component of cognitive apprenticeship that emphasized individuals that negotiate meaning together (Collins et al., 1989).

Argumentation provides a vehicle for social learning and problem solving (Baker, 2003). Either participants will offer up multiple solutions to a given problem or one individual will offer a solution that is not agreed upon by all of the other participants. When this occurs, the participants must develop a way to determine which solution is most acceptable or make a solution acceptable to all participants. This, Baker said, takes place either through argumentation or negotiation of meaning.

Wang, Sierra, and Folger (2003) evaluated discourse from an online graduate level course on introductory instructional design. Wang et al. coded for response type categories and corresponding interaction styles. In their study, Wang et al. evaluated the chat transcripts for themes, synthesized the themes with those found in the literature, and subsequently developed response type categories. Two 90-minute chat sessions were used for the analysis. The course used in this setting involved webcasts with both audio and visual components. The researchers note that observations made during the evaluation of the webcasts were critical in the evaluation of the chat sessions.

The setting represented by the research of Wang et al. (2003) is different from the one in the current study. The discourse analysis covers 180 minutes of time. However,

the categories that emerged from the researcher's code work illustrate social interaction related to learning, but not social construction of knowledge specifically. Unlike Gunawardena et al. (1997), while the categories explain the kind of activities that might take place in social construction of knowledge (e.g. argumentation, negotiation, etc.), the coding scheme does not explain the construction of knowledge as much as the potential product of that social construction. But Wang et al. did not look at how knowledge formed so much as the formation of community, specifically in terms of participation, identity, and community; with an emphasis on gender and cultural differences. The researchers indicated a relationship between formation of community and positive learning outcomes in support of the foundational concepts of theoretical frameworks like cognitive apprenticeship (Collins et al., 1989) and community of practice (Wenger, 1998). Wang et al. felt interaction styles played an important part in formation of community.

Wang et al. (2003) emphasized the importance of argumentation and negotiation for community as discovered by their findings. While the research by Wang et al. did not specifically address how social construction of knowledge takes place, through the assessment of strategies like argumentation and negotiation, the research provided an impetus for a closer examination. A predominance of the postings in Wang et al.'s findings was informational, statements to make a point or opinions. Wang et al. did not attempt to place these categories in the context of social learning or even as steps within a negotiation or argumentation process. On the other hand, Gunawardena et al. (1997)

provided a model that does incorporate these communication strategies into a social interaction toward construction of meaning.

Gunawardena and Colleagues' Interaction Analysis Model

Gunawardena, Lowe, and Anderson (1997) began to examine interaction analysis and built their own model based on grounded theory for the examination of computer mediated communication. Their initial study was a preconference debate conducted entirely online. In this setting, there were no learners versus teachers. Instead, everyone came together more as equal participants, although the debate consisted of graduate students. The debate was intended as a learning activity with an emphasis on the development of virtual conferences. In the debate, the participants were to take sides, either for or against a statement made by a debate leader.

The researchers assumed the participants intended to come together to negotiate meaning and to construct knowledge, in contrast to a situation where the knowledge flows one direction from expert to novice (Gunawardena et al., 1997). This approach is very similar to the cognitive apprenticeship approach that transitions from instructor-centered teaching to a student centered focus (Collins et al., 1989).

Gunawardena et al. (1997) examined a number of models for interaction analysis. Gunawardena et al. believed that the rich variety of computer mediated communication inherent in an online environment provided an excellent resource for interaction analysis. Gunawardena et al. wanted to get to how learning took place in a group, how the participants socially constructed knowledge. This meant it was important to develop

some way of mapping the interaction process (Gunawardena et al.) since interaction was the vehicle for social construction of knowledge. Gunawardena et al. viewed social construction of knowledge as a patchwork quilt where the construction process takes place one piece of cloth at a time and builds up to a final product, in this case, knowledge. Individuals represented the pieces of cloth and provided pieces of a conversation toward social construction of knowledge.

Gunawardena et al. (1997) constructed a five phase process (see table 1). The researchers' goal was to capture both tacit, basic negotiation going on when an individual makes a suggestion and another individual offers corroborating agreement; and the more complex negotiation that would take place in the presence of disagreement and negotiation.

Table 1

Interaction Analysis Model (Gunawrdena et al., 1997)

Phases	Description
Phase I	Sharing / Comparing
Phase II	Dissonance / Inconsistency
Phase III	Negotiation of Meaning / Construction of Knowledge
Phase IV	Testing or Modification of New Knowledge
Phase V	Phrasing of Agreement / Use of New Knowledge

Gunawardena et al. (1997) used the model developed from the analysis of the debate to actually analyze the debate. The researchers did find that the format of the debate affected discussions, sometimes the format assisted and other times hindered. The majority of posts were coded for phase one, although in the first part of the debate some participants began to post more phase 3 type of discussions. Over time, more attempts to move from phase one to two and then to phase three became evident. The researchers noted that the tendency was for participants to move toward some sort of compromise. Because moderators tried so hard to keep the sides clearly defined, reaching consensus was not always easy. However, despite this, some threads continued into phase four and five.

Gunawardena et al. (1997) were able to develop a model that demonstrated how participants socially constructed knowledge. The researchers applied the model to another setting, a professionally moderated professional forum. Similar to the original setting, the preponderance of discussion was coded for phase one with a few other postings in each of the other phases. Because of the weight on the first phase, the researchers began to question the validity of the model. However, subsequent reviews lead the researchers to believe the model accurately reflected the social construction of knowledge that took place in the professional forum. The researchers did indicate the need for further research across different types of learning environments.

The Interaction Analysis Model in an Online Classroom Setting

Moore and Marra (2005) employed Gunawardena et al.'s (1997) model to an online graduate course on instructional design. The research questions that drove Moore and Marra's research centered on whether social construction of knowledge occurred in two different forums, each with its own participation protocols, and whether participation protocols affected social construction of knowledge. The 15-week course was a required part of the Educational Technology curriculum, though some participants were in masters' level programs and others were in PhD level programs. The course used the Blackboard course management system, and discussion boards represented 5% of the overall grade for the course. The course participants were also assigned to teams to address case studies.

One group was told to follow common protocols for participation in the discussion boards and for participation on the case studies (Moore & Marra, 2005). The second group was told to formalize arguments in support of any position stated in the discussions. The arguments were to include a thesis, evidence, assumption, and synthesis.

Discussion board transcripts were coded against Gunawardena et al. (1997) interaction analysis model (Moore & Marra, 2005). The researchers found that students in both groups engaged in all of the first three stages of the interaction analysis model. However, few postings represented stage four or five. Similar to what Gunawardena et al. found, a large number of postings were coded as phase one. However, a fairly large number were also coded as phase two and three for the first group (a smaller number were recorded for phase three in the second group). A chi-square analysis revealed that

the participation protocols play a significant role in the amount of postings at the higher stages. While Moore and Marra found evidence of social construction of knowledge, the protocols designed for the second group resulted in fewer postings, especially of stages four and five of Gunawardena et al.'s model. Moore and Marra appeared to have more postings across the first three phases as compared to Gunawardena et al. who found the majority of discussions to be coded as phase one.

Summary

While Gunawardena et al. (1997) and subsequent research confirmed the efficacy of the interaction analysis model, there is less available research in regards to the use of this model in a long term, semiformal asynchronous learning environment. Gunawardena et al. used a semiformal setting, but with an argumentative goal from the start. Participants were to respond for or against an issue. Moore and Marra (2005) explored the use of the model in a formal classroom. However, in Moore and Marra's research, attempts to establish formalized argumentation protocol adversely affected the number of postings and the use of higher stages of Gunawardena et al.'s model.

The lab was not developed specifically to address social construction of knowledge and no efforts to encourage student debate, negotiation or argumentation were made. However, earlier research did confirm that the lab fit well within both the cognitive apprenticeship model (Collins et al., 1989) and the community of practice model (Wenger, 1998). Both of these models incorporate social formation of knowledge.

Therefore, the model proposed by Gunawardena et al. (1997) provided an excellent point to start for an analysis of this phenomenon.

The next chapter introduces the research methodology for the current study. The chapter describes the methodology development for this study as a secondary data analysis that stems from an earlier case study on the lab. Chapter 3 explains how the current study proposes to use Gunawardena et al.'s (1997) model as a mixed methods approach to understand how discourse analysis measures social construction of knowledge.

Chapter 4 provides an analysis of the data. The chapter outlines findings for each of the phases as well as an examination of the role of the instructor. Finally, the chapter analyzes the phases over the 24 weeks of data that were coded. Chapter 5 examines the findings in greater depth and discusses how the findings fit with existing literature related to the theoretical framework as well as the literature related to the interaction analysis model. Chapter 5 concludes with a review of who may be interested in the findings and suggestions for future research.

CHAPTER 3:

RESEARCH METHOD

The current study expands upon an earlier study (Cawthon & Harris, 2008), described in the previous chapter, which explored the efficacy of the lab as an online research training environment similar to opportunities experienced by graduate students in traditional settings. The current study specifically explored the social construction of knowledge and meaning, as a significant part of cognitive apprenticeship (Collins et al., 1989) and of community of practice (Wenger, 1998). The goal was to build on the current literature through exploration of how participants construct knowledge in a social setting within a primarily asynchronous environment that is both semiformal and long term, much longer than the traditional graduate course that covers a single quarter or semester.

This chapter presents a description of the research design and procedures for the current study. The first section will introduce the qualitative research design and how this design extends from an earlier study on the lab. This section will then discuss the rationale for secondary data analysis and discuss how secondary data analysis will assess the original data.

The second section will discuss the specific procedures used for the current study. This section will discuss the data collection and ethical considerations, which stem from the earlier study. The section will then examine the mixed methods data analysis used for the current study that includes a detailed description of the units of analysis, coding method, and the method used to ensure inter-rater reliability.

Research Design

The original design was a case study that incorporated multiple data collection approaches, as recommended by Creswell (1998), which included (a) a survey, (b) a classroom community inventory, (c) a semi-structured interview, and (d) discussion and chat data available through the classroom software. For the current study, the original plan was to use data from chat and discussion board transcripts available from the five quarters the lab was offered. Coding the data proved to be especially time consuming due to the need to carefully analyze and reanalyze postings and place them in context. After 4 months of working on a single quarter of discussion data, The principal investigator met with the dissertation chair and requested that only two quarters of data be used for the dissertation data analysis phase as opposed to the original four quarter goal. The dissertation chair agreed. The principal investigator made the assumption that two quarters would be enough time to see if time was a factor in the presence of phases, especially phases II-V. The sample size was still 1739 records and included 17 participants, more than enough for a case study (Creswell, 1998). The principal investigator also made the assumption that all phases would be present in just two quarters of data and all phases were present.

Data coding is discussed in greater depth below. All 12 weeks of each of the first two quarters were then manipulated as described above into MS Excel. This process produced 1739 records of data for the data analysis phase of this study. This study was a longitudinal case study as the data source is bounded by time and environment (Creswell, 1998).

The Dataset

The Walden University School of Psychology provided approval for the initial study at the conclusion of the lab. As part of the original approval, Dr. Cawthon downloaded and saved each week of discussion board data to separate Word files. The records were all in the following format:

Current Forum: Week Five Read 31 times
Date: Fri Sep 24 2004 2:36 pm
Author: SC
Subject: Reporting Framework for Recruitment Tool Assignments
Hello! First, please read the Course Documents Section -- Week Five -- for a discussion of the various recruitment tools and your group assignment (Week 5 Discussions, Fall Term, 2004)

Both of the quarters used for data analysis came from Blackboard software. Each quarter of data consisted of 12 weeks. Each week represented approximately 40-80 postings. Seventeen students participated in the two quarters used for data analysis.

The principal investigator participated in the original lab and in the original study on the lab described above and was covered under the Institutional Review Board (IRB) approval for the latter study. However, a new IRB application was submitted for the current study that follows the guidelines for research that uses archival data. The approval number for the current study was 03-06-08-0283343.

Because the principal investigator participated in the lab, she had an in-depth knowledge of the discussions that took place in the discussion board and chat transcripts. That knowledge was based on both participation in the various facets plus the first research study which analyzed transcripts, interview data and other materials associated

with the lab. This knowledge of the discussions helped to recognize projects, which helped to see how responses tied together. This knowledge of the original lab indicated a potential bias by the principal investigator for the presence of social construction of knowledge. This bias was enhanced by the knowledge of the participant perceptions collected as part of the original study about the lab. To help combat this bias, a second researcher reviewed 24% of the coding to ensure inter-rater reliability. The percentage of inter-rater reliability occurred because the inter-rater was unable to provide reliability for 100% of the data due to time constraints discussed in depth below. Typically, inter-rater reliability for qualitative research involves only a sub-sample of the data (Marques & McCall, 2005). The inter-rater was also a part of the lab, but she did not participate during the timeframe represented by the data used for this study.

It was not practical to conduct a new, long term study. The original data were still available and the principal investigator was a part of the initial research study, familiar with the data and how it was collected, and part of the application for IRB approval obtained with the first study. Therefore, since this current study sought to expand earlier research within a specific area, secondary data analysis made the most sense.

Secondary Data Analysis

Data collection can be a long and strenuous process and potentially impractical when a study encompasses long periods of time. Secondary data analysis provides opportunities for in depth analyses of the data that already exists and extends prior studies or delves deeper into questions raised by those studies (Kiecolt & Nathan, 1985). A

secondary data discourse analysis proves to be the most effective way to explore social construction of knowledge. This study provides both potential benefits and pitfalls with this methodology, which expands understanding of application of the interaction analysis model proposed by Gunawardena, et al. (1997), and provides insight to other educational researchers interested in secondary data discourse analyses.

Data Collection and Coding

An analysis of the interaction between participants in a dialogue is necessary in order to understand how these participants constructed meaning and knowledge. This approach dictates a primarily qualitative approach (Fairclough, 2006). However, the data underwent a mixed analysis, quantified through coding, which produced data that could provide frequencies then be documented and discussed qualitatively (Chi, 1997; Tashakkori & Teddlie, 1998). The current study represented a qualitative methodology in that only the discussion board data was coded with the interaction analysis model proposed by Gunawardena et al. (1997). In chapter 4, the data is presented using a mixed methods approach as recommended by Chi and Tashakkori and Teddlie.

Data Collection and Ethical Considerations

As described above, the data used in this study were collected under the original study about the lab. This data were collected by the original study's principal investigator, Dr. Cawthon and saved, by week, to MS Word. The proposed study's data is protected under the American Psychological Association's (APA) Ethical Principles of

Psychologists (2002) section 8.05a that indicated a researcher may dispense of the consent process when the study involves typical aspects of education (APA, 2002). Therefore, no consent was requested for the use of these data in the original study and none was obtained for the current study.

The data were reviewed to change any reference to identity to initials. If an individual provided information of a personal nature in the discussion or chats, this data was not coded unless it specifically related to a component of the interaction analysis model. Only the principal investigator, and the dissertation chair, will maintain any record of the original data.

Pilot Study and Issues

For the pilot, the first quarter data were coded with Gunawardena et al.'s (1997) interaction analysis model. The methodology proved to be an appropriate approach to the analysis of social construction of knowledge in that examples of each phase of the interaction analysis model could be clearly gleaned from the data (see Table 2) which fit well with findings by Gunawardena et al. (1997) and Moore and Marra (2005). However, the methodology presented a couple of issues that were considered for the study.

Table 2

Frequency of Phases for First Quarter Pilot (N = 2314)

Phases	Frequency of Relevant Postings
Phase I	686
Phase II	160
Phase III	63
Phase IV	8
Phase V	0

Units of Analysis. Secondary data proved difficult to use for discourse analysis after the material has been adapted for units of analysis in previous research. For the initial study, the first quarter discussion board data were broken down into units for analysis that were usually paragraphs within a single individual's posting or single postings of a paragraph or less. As a result, it was difficult to follow the threading of comments by one person to comments by another person. Breaking the units of analysis into full discussion posts made threading, especially with the use of the MS Excel autofilter function, much easier. The relationship of comments within postings and between postings is essential to understand discourse analysis (Fairclough, 2006).

Coding. Coding for elements of the interaction analysis model was also a challenge during the pilot process and remained a challenge for the study for both the

inter-rater and the principal investigator. At the end of the pilot process the principal investigator decided that in a learning environment intended to foster knowledge of research, it would seem any knowledge related to research activities should be applicable. For example, in the first quarter, students learned how to put together a survey. Dissonance occurred as students determined the best possible way to collect data. In the pilot effort, these were marked as phase II because they displayed conflict as participants worked out their understanding of the best way to create a survey for the project in which they worked. It was thought that this difficulty would be tempered by the use of an inter-rater. The difficulty in coding required lengthy discussion in order to reach 95% agreement.

The lab's environment. In the lab, the learning environment was not instructor centered and the instructor adopted a *fellow researcher* role for the most part. This setting is somewhat similar to that used by Gunawardena et al. (1997) for the development of their interaction analysis model in that it was not the formal classroom type of environment. There was no stipulated requirement for argumentation or debate such as those employed by Moore and Marra (2005). Instead, conversations were allowed to flow naturally with guidance only in the form of requests by the instructor for students to provide their thoughts on different aspects of the project as it progressed. It was necessary to decide if dissonance connoted outright disagreement or if it extended to the implication of a lack of complete agreement. In the pilot effort, some phase II dissension was more rhetorical in nature, where a participant might voice issue with information, a case of less than full agreement but not outright disagreement. In some of these cases, no

further effort to negotiate understanding took place. In some situations the student agreed with the idea, but with a qualifier such as a suggestion that gives evidence of adaptation to the participants' framework of knowledge (Gunawardena et al. 1997). The goal was that the inter-rater would, again, provide some assistance to assure that interpretations of data within the interaction analysis model make sense. The discussion above shows that during the study, the inter-rater did help to clarify where dissonance occurred.

Units of Analysis for the Study

Each week's discussions were broken into units of analysis where each unit represented an entire posting by one individual. Extra lines and spaces from the MS Word file were removed and the data were copied and pasted into a MS Excel file. The data were coordinated into columns: (a) Current Forum, which was changed to just a week number; (b) Date; (c) Author; (d) Subject; and (e) the posting. Five columns were added for the five phases (See Table 1). The data had to be copied and pasted item by item.

Originally, the data were divided into different MS Excel files by week. Next, the data were put together into two MS Excel files, one for each quarter. Finally, after all coding was complete; the data were merged into a single MS Excel file. A second MS Excel worksheet was used to convert the data for use in the SPSS software.

Each individual represented by the Author field was assigned a number and the MS Excel file updated to show the number rather than the individual's name. The word *Date* was removed from the date fields. For the SPSS file, the date, subject and posting

fields were removed. A field for record number, quarter number, and inter-rater code were added. The inter-rater process is discussed further later in this chapter. The final SPSS file contained the following fields for each record: (a) ID, (b) quarter, (c) week, (d) author, (e) Phase I, (f) Phase II, (g) Phase III, (h) Phase IV, (i) Phase V, and (j) inter-rater.

Coding

The discussion board data, from the first two quarters, were coded for the five phases of the interaction analysis model proposed by Gunawardena et al. (1997) as a method to model discourse analysis of social construction of knowledge that involves dissonance or argumentation (See Table 1). This model was chosen because conflict is especially valuable for social construction of knowledge (Baker, 2003). This model was also useful for the identification of areas of dissonance where students did not accept ideas at face value.

Because the posts were no longer in a threaded format, where a reply immediately follows the message to which it relates, the biggest issue for coding proved to be connecting posts so that a logical conversation was evident. To facilitate this, the autofilter function found in MS Excel was used. The autofilter function allowed sorting by any item in that column. By using the column for subject, meaning the subject provided by the student when he or she made the original posting, it was possible to have only threads for a certain subject show. For example, in the following record, the

autofilter would have allowed only records with the subject, “Reporting Framework for Recruitment Tool Assignments.”

Current Forum: Week Five Read 31 times

Date: Fri Sep 24 2004 2:36 pm

Author: SC

Subject: Reporting Framework for Recruitment Tool Assignments

Hello! First, please read the Course Documents Section -- Week Five -- for a discussion of the various recruitment tools and your group assignment...
(Week 5 Discussions, Fall Term, 2004)

This process could not account for times when posters changed the subject line but continued the same conversation. However, by filtering in this manner, conversations were considerably easier to follow.

Each record was coded with a one for each of the phases present. If a phase was not present, a zero was entered. In some cases, multiple phases appeared in single posts. For example, the following post was coded with a one for phases 1, 2, and 3 (for this and all subsequent postings, see Table 3 for a highlighting guide):

RJ, I do agree with the dual method of conduction of the survey (phase II – agreeing with an earlier disagreement) and I think 15 to 20 minutes is appropriate for a teacher to give to answer a survey that can only benefit them (phase I). maybe some type of incentive should be given in order to increase participation (phase III). (Week 1 Discussions, Fall Term, 2004)

The posting showed sharing of information, continued exploration of a disagreement presented in an earlier post (RJ agreed with the disagreement discussion) and began to negotiate the knowledge, which in this case was the discussion of how to ensure participants completed the study’s survey. In this post, the participant also presented an idea in the form of incentives.

The identity of the poster was not considered during the coding process. Postings made by the instructor were treated as any other posting. The ratings reflected only the information contained in the posting or the information in other postings to which the specific posting related. The principal investigator was also a participant in the study. Both the inter-rater and the principal investigator treated these postings the same as any other. The passage of nearly four years made it so that the principal investigator did not recognize her own postings. The inter-rater was also a participant. However, the inter-rater did not join the study until the third quarter and this data only included the first two quarters.

Inter-rater Reliability

A second individual was asked to provide inter-rater reliability. The inter-rater was selected based on her familiarity with coding qualitative data and her familiarity with the lab from which the data comes, and that this familiarity with the motivations and issues behind discussions and chats would aid her in better understanding when individuals expressed dissonance or agreement.

Once IRB provided approval for the current study, the inter-rater training was provided with the phenomenon under study and the model used to code for the phenomenon (See Appendix B). The training consisted of an independent review of the interaction analysis model and studies and their results with this model through the assignment of two key articles. The first article was the study conducted by Gunawardena

et al. (1997) which established the interaction analysis model. The second article was the study conducted by Moore and Marra (2005).

The goal was to review 2-week increments independently until 95% agreement could be reached. Both the inter-rater and the principal investigator independently reviewed the first 2 weeks of the first quarter and compared results. The goal was to achieve 95% inter-rater reliability. The inter-rater and the principal investigator initially had roughly 70% agreement. They discussed discrepancies and issues until they reached 95% agreement. This took nearly 3 months. As stated earlier, the current study assumed that agreement for the constructs under study was achievable between the principal investigator and the inter-rater. Such agreement was reached by discussing discrepancies until consensus could be achieved.

Issues During the Inter-rater Reliability Process

By this time, working with the dissertation chair, the decision had been reached to reduce the data analysis to two quarters. The goal at this point was for both the inter-rater and principal investigator to code all of the data. At this point, all of the second quarter data was cleaned and provided to the inter-rater. The inter-rater coded 27% ($n = 262$).

The inter-rater was also a dissertator needing time to work on her own project. Having spent so much time already, she felt that it was likely to take several more months and that the process would not bring further clarity than what was already known after working on the first 2 weeks of the first quarter. However, before she reached this point, she had independently coded the 262 records of the second quarter as discussed above.

This was discussed with the dissertation chair and the conclusion was reached that the inter-rater reliability completed to this point would be sufficient. This decision was based on the idea that typically, inter-rater reliability involves a sample of the data rather than 100% of the data (Creswell, 2003). No discussion was conducted between the inter-rater and principal investigator regarding the inter-raters codes for the second quarter, though the principal investigator did consider comments made by the inter-rater justifying the inter-rater's codes. A 95% inter-rater agreement was achieved for the coding conducted for the second quarter.

A total of 24% of the study's records ($n = 410$) were coded by the inter-rater with 95% agreement. The final MS Excel file was coded a zero for records not rated by the inter-rater, a code of one was assigned to records coded by the inter-rater and the principal investigator and where agreement was reached, and a code of two was assigned to records coded by both, but where agreement was not reached.

The inter-rater expressed ongoing concerns with the subjectivity of the coding process. After reading the literature (Gunwardena et al., 1997 ; Moore and Marra, 2005), the inter-rater coded the first week of the first quarter and a number of differing opinion about definitions emerged. For example, it was challenging to differentiate between proposing a problem and presenting an issue or problem as a disagreement to something established earlier. The principal investigator originally coded the following post as a Phase II because it seemed to disagree with the participants' study as it was setup at that time. However, the inter-rater rated it as a Phase I and made a convincing argument that it was only the presentation of a problem, not a problem with an already established idea or

piece of knowledge. In the following post, the participant expresses concern over how the group was to establish the survey tool.

In thinking about what we saw last quarter while rereading the documents, I think that there can only be one participant from an institution (to avoid duplication) and that person must have a good idea of what information to glean before taking the survey, since the information we need is most often lumped in with other disabilities. Am I screwed up in this thinking? (Week 1 Discussions, Winter Term, 2004)

What the principal investigator initially interpreted as disagreement she later recognized as the presentation of a problem (phase I), which the participant was emphasizing by tying the problem to the literature read during the first quarter.

The inter-rater and principal investigator discussed the definitions in order to clarify and reach consensus on the material coded thus far. For example, the following email from the principal investigator to the inter-rater clarifies discussion regarding definitions (personal communication, June 24, 2008):

I am telling you about something I know, just learned, etc., about the topic at hand = Phase I. Clarifying the “new idea” (would require the presence of a Phase II) = Phase III. Discussion of the modified approach (which stems from the Phase II) in a manner that relates to personal experience or literature, etc. = Phase IV. Restating a conclusion or directly using that solution = Phase V

The inter-rater replied (personal communication, June 24, 2008):

“The problem I have had with coding using this phase system is that the data and process seem to not fit the system well, if I go strictly by Guar's chart of the phases & subphases. Your listing, however, seems to fit better, from my perspective. As I recall from the lab, when we coded qual data, we tended to develop our coding system as we went along. This is not the case with your study, where a pre-existing coding system is being utilized. I think this makes the process far more challenging.

From this discussion, 95% agreement was achieved for all of the data coded by both the inter-rater and the principal investigator.

Summary

The available data provide a picture of a semiformal community of practice. While a challenge, the model proposed by Gunawardena et al. (1997) provided an appropriate method for the capture of student interaction and dissonance as shown by the pilot study. The computer mediated communication, in the form of discussion boards and chat room dialogues, provides a view of students' social construction of knowledge that would be otherwise difficult to obtain, especially for a period that covers five quarters.

Mixed methods research projects that incorporate secondary data analysis, especially discourse analysis, can provide valuable insight into various facets of the learning process. As one participant said, "Research is HARD work! Yikes." However, with judicious use of secondary discourse data, despite the challenges, research can open a window on student thinking, and pave the way for pedagogical adaptation. The current study added to the literature in two ways. First, the study expanded the interaction analysis model proposed by Gunawardena et al. (1997) to longer term, loosely formal, community of practice learning environments, which demonstrates evidence participants adapt their understanding as a result of the interaction. Second, the literature showed the pitfalls and benefits of secondary discourse analysis data and provided evidence of the potential for this methodological approach.

The next chapter provides an analysis of the data. The chapter provides a discussion of each phase. Chapter 4 also provides an analysis of the instructor participation and concludes with an examination of phase use over time. Chapter 5 examines the findings within existing literature related to both the theoretical framework

as well as the interaction analysis model. This chapter discusses who may be interested in the findings and how the findings contribute to social change. Finally, chapter 5 concludes with a discussion of additional research.

CHAPTER 4:

RESULTS OF THE STUDY

Introduction

This study used a qualitative research design with a mixed methods analysis to answer the following research questions: Does socially constructed meaning and knowledge occur in a long term, semiformal, asynchronous learning environment? If so, how does socially constructed meaning and knowledge form in this environment? The data consisted of postings made by students participating in an online research lab. The data were not reviewed for emerging themes. Instead, the data were coded using the five phases of social construction of knowledge developed by Gunwardena et al. (1997).

This chapter presents the results of the data coding and analysis. The results are presented in a mixed method format. Quantitative information is provided in the form of frequency data, while qualitative excerpts are used to demonstrate the presence of each phase. The findings demonstrated the presence of social construction of knowledge and show formation of knowledge through the various phases. Furthermore, the data showed that in some cases, certain phases may not have to be present for knowledge to form. Chapter 5 will discuss the findings in the context of current literature.

The Findings

The goal of this study was to explore the research question of whether socially constructed meaning and knowledge occur in a long term, semiformal, learning environment. Furthermore, the study explored the second research question of how such

socially constructed meaning formed in this kind of environment. Two quarters worth of postings provided evidence for all phases of the model proposed by Gunawardena et al. (1997). Each of the phases is discussed in greater detail below.

Phase I

Phase I represented the majority of the phases used by participants in the study (n = 982; 56.5% of the posts). This mirrors findings by both Gunawardena et al. (1997) and Moore and Marra (2005). Phase I included posts sharing information as well as posts presenting problem statements (Gunawardena et al., 1997).

In some cases, students demonstrated learning through the use of just phase I. For example, in the following series of posts, each coded as a Phase I, two individuals converse on the website that one participant has put together for the study and that the other participant is reviewing:

PS, Wonder what the motivation is behind having the navigation bar on one side versus the other? I wonder if there is some basis for the predominance of it being on the left? I do agree with you though. That is where I have seen it almost exclusively. RJ

RJ, You wrote: "I wonder if there is some basis for the predominance of it being on the left?" To answer that question, the Western world reads from left to right but its because we were taught to do so. Intuitively (Naturally) the human eye looks right before left. Web designers are beginning to recognize that natural tendency and are placing navigation to the right instead of the left. Basically they (web designers) are looking for any advantage (however small) to keep people at their sites. PS

PS, Thanks for sharing! That was interesting and you know, now that you mention it, I do have a tendency to look right before I look left. RJ.
(Week 6 Discussions, Fall Term, 2004)

Such evidence of learning, even from just the use of sharing and comparing, phase I, began to demonstrate how participants engaged in social construction of knowledge, the

second research question. However, as the following sections show, students also constructed knowledge through disagreement, or lack of agreement.

Phase II

Phase II included 217 posts, 12.5% of the total posts. The majority of disagreements took the form of lack of total agreement. In some cases the disagreement was overt, for example:

Post your thoughts on the following: What are three methodological/logistical challenges that you think we will need to think critically about in developing an online survey of teachers? In reviewing my classmates' response to this question, I responded with concern about the method of delivery, which SC explained would be conducted by a survey company [phase II]. I also believe I read some posts where concerns were raised about the demand characteristic of social desirability (Heiman, 2002). I like the ideas presented but I am just wondering about the launching platform for the survey--whether the participant is directed straight to the survey or if they are sent to the site which is the web representation of this study and then linked to the survey [phase II]. Another thought about the survey instrument mentioned in the survey proposal is the length of time suggested for the survey (SC, 2004). Although 20 minutes does not sound like a long time, in my experience of taking surveys for marketing companies that after 15 minutes I begin to lose interest. Out of curiosity, I went to look for marketing research on attention spans for survey takers and found that the average length in which you are able to engage your surveying audience is 15 minutes--now I just have to find the info again so I can back my statement. It was a search I did several months ago out of pure curiosity not for the purpose of a paper but rather from a marketing standpoint. I guess I never know when what I consider pure trivia might come in handy. (Week 2 Discussions, Fall Term, 2004)

In other cases the disagreement was more challenging to discern. For example, in the following posting, the participant ends up expressing a lack of complete agreement with SM's posting:

SM, Your last paragraph is an important one for us to consider -- it will affect both who we ask and what kind of format we use for data collection. If we want to know what the IEP says for an individual student, we are looking at very fine-

grained data requiring basically a one-to-one (or one-to-few) ratio between the survey participants and the students they represent. However, if we are asking for aggregate data -- say in a district -- we get a different level of specificity. We might be able to get a database from a district that has counts of a) students who are DHH b) their test participation c) number who have IEPs. Unless we can access this student by student, our unit of analysis becomes the DISTRICT, not the STUDENT [concern and lack of agreement – phase II]. Our statistics approach will obviously change depending on the unit of analysis. We may want to initially pursue both paths in our development of the study, as they challenge us to think clearly about our methods and proposed analysis. (Week 2 Discussions, Fall Term, 2004)

The phase II postings showed that participants did not always agree with ideas presented by other participants.

Phase III

Phase III is the negotiation of meaning and coconstruction of knowledge. A total of 165 records were coded for Phase III, 9.5% of the posts. Phase III might involve clarification of meaning as well as the proposition of new ideas stemming from a disagreement or dissonance. In some cases, this was the negotiation or coconstruction of knowledge related to a product. The presence of phase III demonstrated that participants were forming new knowledge stemming from their own or another person's disagreement. This goes to establishing how the students socially constructed knowledge helping to answer both research questions: does social construction of knowledge occur and how does it occur?

Since knowledge in the lab included how to conduct research, construction of knowledge included knowledge about how to solve research problems. For example, as participants worked out the survey, they began to discover the challenge of making a

survey that would be understandable to participants. The following posting came after discussion on both questions and the need for a pilot process. In this case, it took place within a conversation of coconstruction of knowledge regarding the piloting process as the resolution to an issue about survey questions:

Hi, I think you're both right -- we definitely need to pilot our questions so that we know what kinds of answers people want to put that we don't have choices for! If enough come up with that "other" we may end up revising the question to include it. But in any case, an : "other" with a text box is imperative [brings together ideas to clarify a new concept – phase III]. (Week 2 Discussions, Fall Term, 2004)

Another example involved the negotiaton the meaning of an idea related to the recruitment process: “I thought it might be an insert, something that could be copied or posted for individuals to share with others” (Week 6 Discussions, Fall Term, 2004).

Phase IV

A total of 60 records were coded for Phase IV, 3.5% of the total postings. It was difficult at times to differentiate phase IV from phase III. Phase IV focuses on the testing and modification of the proposed synthesis of knowledge developed through the disagreement of phase II or the negotiation of meaning in Phase III. Gunawardena et al (1997) stressed phase IV as testing the new knowledge against what is already known. There were no discernable instances where a phase IV posting specifically tested knowledge against the literature. However, at times the testing against what was known by the participant was implied. For example,

SC, I think that focusing on accomodations is vital here. Although the grades may be same accomodations will not. Some facilities and/or institutions have accomodations not available to others. What do you think?[testing against personal knowledge – Phase IV] (Week 8 Discussions, Fall Term, 2004)

In the above posting, the participant clearly tests the knowledge, but the implication is that she has the knowledge against which she makes the test. No posting coded for phase IV provided references.

Sometimes, the item was coded for Phase IV when the implication existed that the poster was testing the new knowledge against something he or she already knew, perhaps from discussion earlier in the quarter, from literature read, or from personal knowledge or experience. For example, one person responded, “You make an excellent point. Accommodations will be different even if a student is in the same grade.” (Week 8 Discussions, Fall Term, 2004) This was coded as a Phase IV because it implied the individual was testing the proposed idea against what he or she considered current knowledge. In the above example, the testing was implied.

Phase V

Eighteen posts demonstrated the characteristics of phase V, the application of newly constructed meaning. This represented 1% of the total posts made for the two quarters. In some cases, phase V was represented by an actual product. For example, after discussing one of the recruitment letters, a final product integrating the discussion and disagreement was posted for students to review. In other cases, it was difficult to code products as a phase V without the actual product. At times items representing a phase V occurred well after discussion about the item. For example, a recruitment letter was discussed over multiple weeks of the second quarter. At the end of Week 9, a final product was posted representing earlier discussion, disagreement and formation of agreed

upon knowledge, “OK...we now have a final draft of our letter. This is one that can be used for snail mail or email” (Week 9 Discussions, Winter Term, 2004). In at least one case, a posting included phases 2 through 5, though the phases did not necessarily pertain to each other:

I went through the questionnaire again and made the notes as I went through it [phase V because this was a product created through negotiation of meaning. Phase III because the student continues to negotiate meaning]. I must admit, that I find this course useful for me, but I fear I am of little use to the project. I am doing my best, but I am still lost and shell shocked. I truly hope this is what you expected. I am still having a problem with question 5 [phase II]. I am not sure how to demonstrate that my school has one of several district deaf ed programs that is run inside of our magnet school. On question 7, I am not sure what the program is called, but I am sure the people in the program would. But this does illustrate how little the program interacts with the mainstreamed school [phase IV, testing against experience, but also phase II in that it offers of a “new” disagreement]. I have been there for 12 years, and have come in contact with that portion regularly, but not from the designation of program perspective. Is question 16 different? It looks good, but why are we clumping grades together? Question 17 seems to be an incredibly important question. Will they have this readily, or will they have to do the calculations. If they do have to calculate--then having a second survey filled out by that school would be important for verification. I take it that question 18 like the rest of the questions all have to do with the 2003-2004 school year. Especially since the populations change (at least at the school level). Question 19 is now more meaningful since I have learned that not all dhh students have IEPs. Question 24 asks how many people took the test. How do we know at what grade the test was administered? If we do not know that, then how can we asses the percentage of compliance? I like how the program jumped for no questions [phase V – This aspect developed from earlier discussion]. I went back several times to enter yes and then went back to answer no to see how it would jump. (Week 5 Discussions, Winter Term, 2004)

In the posting, the participant discusses concerns, or dissension against the agreed upon product, proposes and modifies some ideas also discussed in other postings and tests some previously discussed knowledge. Finally the participant also agrees with the final product in several ways.

Postings with Multiple Phases

Many postings included several phases. Table 3 provides a breakdown of how often phases occurred together. Using the entire discussion posting as a unit of analysis made coding much easier both for connecting posts together, but also for seeing how participants expanded thoughts to include not just one, but multiple phases.

Table 3

Occurrences of Phases Together

Phase	Amount	% of all posts made
1 only	863	49.6
1 & 2	71	4.1
1 & 3	14	0.8
1 & 4	5	0.2
1 & 5	2	0.1
1 & 2 & 3	21	1.2
1 & 2 & 3 & 4	5	0.2
All	0	0.0
2 only	66	3.8
2 & 3	47	2.7
2 & 4	0	0.0
2 & 5	0	0.0
2 & 3 & 4	4	0.2
2 & 3 & 4 & 5	0	0.0
3 only	47	2.7
3 & 4	20	1.2
3 & 5	0	0.0
3 & 4 & 5	0	0.0
4 only	17	0.9
4 & 5	0	0.0
5 only	10	0.6

Presence of Phases IV or V without a Phase III or IV in the Discussion Thread

While all phases were present, in some situation, a conversation would skip phases and jump to testing of constructed knowledge or final products. Students would debate topics and move on to final understanding without any obvious negotiation of meaning. For example, in regards to a posted recruitment letter, one student wrote, “While the letter is very good, my one concern would be the length of it” (Week 9

Discussions, Winter Term, 2004). This post was coded a Phase II. No posts clearly demonstrated a phase III or a phase IV. However, immediately after the posting of a revised letter, a student wrote, “This seems much better. I guess brevity really is key with a lot of folks when it comes to determining whether they will take the time to read something or not” (Week 9 Discussions, Winter Term, 2004). This post, as well as the posting of the actual revised letter, was coded for phase V.

Other Aspects of the Findings

Teacher role. The postings were coded for all of the phases regardless of the author. This meant that the instructor’s postings were treated the same as any other participant’s postings. The instructor engaged in all five phases (see Table 4). Even though the instructor had multiple roles of instructor and principal investigator, her discussion participation is on a more equal basis. Where her discussion postings tended to differ occurred early each week when she set the agenda for the week and when she prompted participants toward turning in needed data and assignments.

Table 4

Summary of the Use of Phase Use by the Instructor

Phase	Number	% of Posts in that Phase
1	250	26%
2	61	28%
3	38	23%
4	17	28%
5	6	33%
None	130	24%
Total Posts	435	25%

Note: Since some posts include multiple phases, the total posts is less than all of the other posts combined.

Time. Time played role in the use of certain phases (see Figure 1). No correlations existed between weeks and phases. Peaks in specific phases typically matched peaks in overall postings. One difficulty in testing the data to explore the role of time was the fact that new topics were introduced every week or two. This is discussed in greater depth below. As a consequence, it was impossible to tell if time as a variable affected the use of the phases.

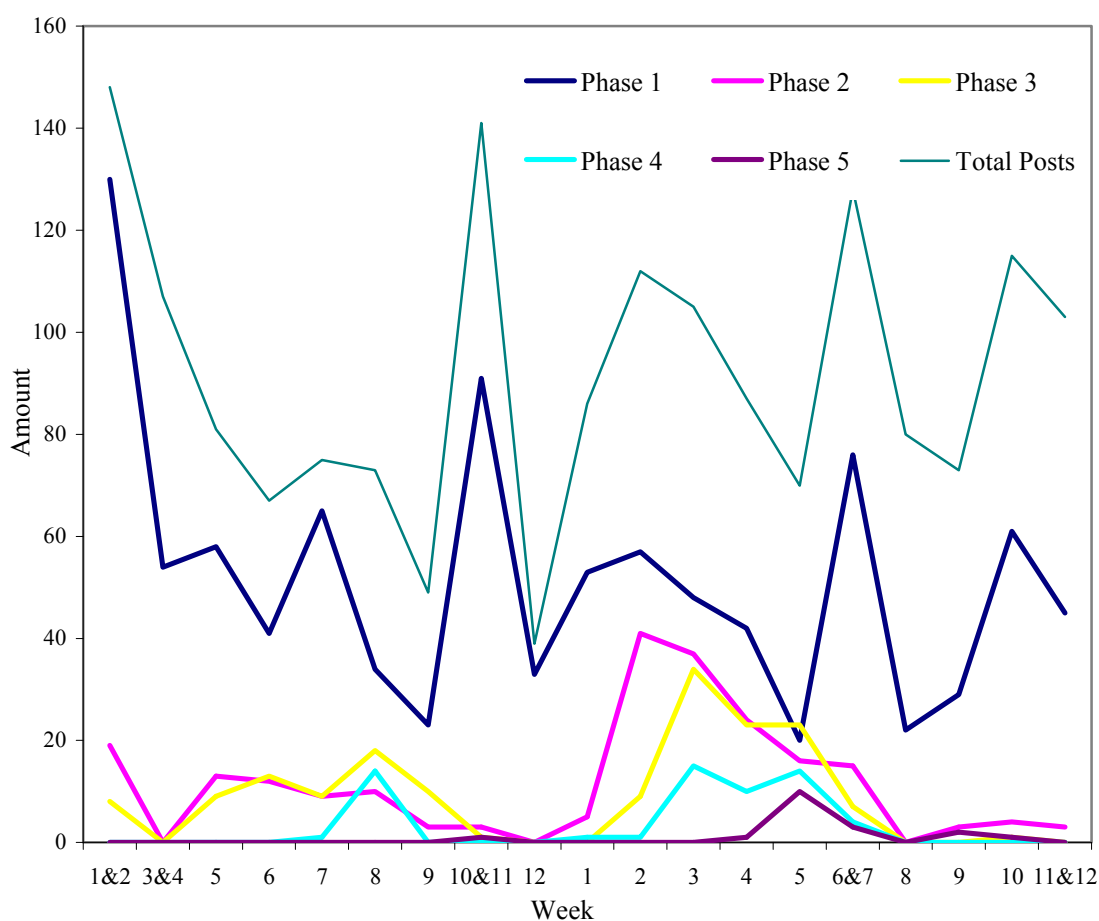


Figure 1. Use of the five phases over two quarters

Use of phases increased when participants engaged in discussion regarding the survey and the website, and recruitment letters. Students interacted and debated these subjects in depth. Week 8 was predominantly about students' providing attachments of data files for each state. Weeks 10-12 of both quarters tended toward wrapping up of activities with week 12 focused on students posting their thoughts about the learning experience.

Table 5

General Topic of Discussion by Week

Quarter	Week	Topic
1	Week 1 & 2	Literature Review
	Week 3 & 4	Literature Review, Recruitment
	Week 5 & 6	Recruitment Process & Tools, Website Creation
	Week 7	Survey Development
	Week 8	Recruitment, Survey Development, Website
	Week 9	Understanding the Piloting Process
	Week 10 & 11	Piloting, Website Development
	Week 12	Participant Reflection
2	Week 1	Review of First Quarter and Literature
	Week 2	Review of Literature and Potential Issues
	Week 3	Pilot Summary, Survey Development
	Week 4	Sampling, Reliability, Validity
	Week 5	Sampling, Recruitment Issues, Survey Refinement
	Week 6 & 7	Recruitment Tools Refinement; Who to Recruit
	Week 8	Sampling
	Week 9	Recruiting
	Week 10	Preliminary Data Analysis
	Week 11 & 12	Participant Reflection

Non-codeable Postings

Some postings did not represent any phases ($n = 541$). These postings might be personal discussion, such as, “MP, My favorite employer used to say, ‘If it's not one thing, it's twenty-five! Hope your foot mends quickly’” (Week 11 Discussions, Winter Term, 2004). In other cases, these posts might be posting of attachments. Noncodeable postings increased during the last couple of weeks of the quarter when students posted thoughts that could not directly be tied to knowledge-forming discussion. For example:

Please find attached my reflection paper. On a more personal note, I would like to thank SC and all the students involved in this endeavor for encouraging me and helping to make me feel accepted. (Week 11 Discussions, Winter Term, 2004)

Much of the noncodeable postings represented socializing, something the instructor promoted as part of community building (Cawthon & Harris, 2008).

Summary of Findings in Relation to the Research Questions

The data included all five phases of the interaction analysis model (Gunawardena et al., 1997). Postings coded for each phase provided evidence of participants engaging in acts of social construction of knowledge. Chapter 2 shows how the model demonstrates social construction of knowledge. The data provided solid evidence for the existence of each phase.

The second research question asks how social construction of knowledge occurred in this long term, two quarter, environment. The examples of each phase provided a snapshot of how participants formed knowledge. In some cases, as discussed above, individuals learned from the sharing and comparing of knowledge. In other cases, participants needed to explore alternative ideas in the form of dissonance, which initiated the process of socially constructing knowledge. At times, participants negotiated and tested meaning explored through dissonance.

Chapter 5 provides a more in-depth discussion of how the data fits the literature. The last chapter will explore interpretations of the findings, the role of the researcher, and examine the findings in terms of their implications for social change. Finally, the chapter

will provide recommendations for the use of the data from this study, as well as suggestions for further study.

CHAPTER 5:

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Overview of the Study

This qualitative study explored social construction of knowledge in a long term, semiformal, asynchronous learning environment in order to answer the following research questions: Does socially constructed meaning and knowledge occur in this type of environment, and if so, how does socially constructed meaning and knowledge form in such an environment? The data spanned two quarters, a total of 24 weeks. Unlike earlier studies conducted by Gunawardena et al. (1997) or Moore and Marra (2005), the learning environment in this study was less formal than the environment was not a debate format such as that used by Gunawardena et al. nor were instructions provided encouraging participants to disagree and debate topics under study like that in Moore and Marra's study. Despite the fact that the setting did not directly require disagreement, dissonance took place as evidenced in the use of phase II and the subsequent phases to construct new knowledge out of the dissonance, with a 95% inter-rater reliability achieved for 24% of the postings.

This study showed that social construction of knowledge does occur in a long-term, semiformal, asynchronous learning environment. Participants demonstrated learning through the use of sharing and comparing knowledge, phase I. However, socially constructed knowledge, as defined by Gunawardena et al. (1997) also occurred through negotiation and modification of meaning (phase III) and testing of new knowledge (phase

IV). Additionally, evidence of the application of group constructed understanding (phase V) took the form of final products as well as statements of understanding.

In the next sections, this chapter looks at the interpretation of the results and how these results fit with the literature. Additionally, the chapter shows how these results can be used for social change. Finally, the chapter discusses the benefits of this study for other researchers and educators and explores the need for more study.

Brief Summary of the Findings

Participants used all five phases of the interaction analysis model (Gunawardena et al. (1997) over the course of two quarters (24 weeks). Data demonstrated the presence of social construction of knowledge. First, the posts demonstrated social construction of knowledge through the presence of phases II through V. While only one post was coded for phase V in the first quarter, 17 posts exhibited characteristics of phase V in the second quarter. As with both Gunawardena et al. (1997) second application of the model and Moore and Marra's (2005) study, participants predominantly used phase I posts. However, this study's findings for phases II through V are similar to Moore and Marra and exceed those found by Gunawardena in their second application of the model. Even though the setting did not inherently involve a debate type of environment and there were no instructions for dissonance, students naturally expressed differing opinions and then worked together to form common understanding. The next section explores the findings in greater depth.

Interpretation of the Findings

Two critical components formed the foundation of the study by Gunawardena et al. (1997) from which the interaction analysis model emerged. First, the researchers examined whether knowledge was constructed by the group. Second, the researchers looked for individual participant's change in understanding or creation of new understanding. Both of these occurred in the present study. Individuals demonstrated new knowledge and stated the acquisition of new knowledge (see also Cawthon & Harris, 2008). Furthermore, the interaction inherent in the act of disagreeing, negotiating meaning, testing and modifying meaning, and applying new knowledge (Gunawardena et al., 1997) demonstrated by the presence of phases II through V provide evidence for social construction of knowledge.

The Phases and Constructivism

Gunawardena et al. (1997) established the interaction analysis model on a foundation of constructivist learning principles. In the current study, students often built new knowledge based on past knowledge, interests and attitudes; all important factors in constructivism (Fosnot, 1996; Howe & Berv, 2000; Richardson, 2003). Such use of past experience was readily apparent through the phase II through IV postings. For example, in the following phase II posting, an individual expressed disagreement with the survey instrument based on the experiences he brought to the lab:

I am still having a problem with question 5. I am not sure how to demonstrate that my school has one of several district deaf ed programs that is run inside of our magnet school. On question 7, I am not sure what the program is called, but I am sure the people in the program would. But this does illustrate how little the

program interacts with the mainstreamed school. I have been there for 12 years, and have come in contact with that portion regularly, but not from the designation of program perspective. (Week 5 Discussions, Winter Term, 2004)

Participants negotiated meaning, phase III, based on past experiences as well. In the following example, the participant negotiated and constructed understanding of the development of survey questions by working through how different entities would report information on the survey instrument and by combining an earlier posting with knowledge already held:

You make an excellent point about the IEP's and classification being based on the most prominent disability in cases when more than one disability is present. Here in NC, and probably in other states as well, this is reflected in coding of test data, in that only the prominent disability is coded. (Week 9 Discussions, Fall Term, 2004)

Students would indicate knowledge gained and then match that knowledge to previous knowledge and experience:

Thanks for the comprehensive explanation, particularly in regards to the percentages. I see what you mean about the percentages adding up to more than 100% but that makes sense to me, given my experience as a testing coordinator. We sometimes had students who took more than one type of alternate assessment, or standardized for one subject and an alternate for the other subject. (Week 5 Discussions, Winter Term, 2004)

Participants constructed new knowledge through the use of the various phases, building on the prior knowledge and interests they brought to the lab.

The phases provide a method of labeling how participants cooperated to form new knowledge. Such cooperation is fundamental to constructivism and is critical even from an early age enabling the child to do in communion what he or she may not be able to do alone (Vygotsky, 1978). The data shows that participants in the lab regularly matched

their emerging knowledge to their past experiences and interests, a significant act in constructivist learning (Fosnot, 1996; Howe & Berv, 2000; Richardson, 2003).

The Phases and Cognitive Apprenticeship and Community of Practice

This constructivist learning approach provided the foundation of learning models like Wenger's (1998) Community of Practice and Collins et al.'s (1989) cognitive apprenticeship. This study focused most on the sociology component of the cognitive apprenticeship model, which was divided into four parts: (a) situated learning, (b) community of practice, (c) intrinsic motivation, and (d) exploitation of cooperation (Collins et al., 1991). Wenger's (1998) model, in many ways mirrored the emphasis by the cognitive apprenticeship model on sociology and the importance of cooperation and community in situated learning (Collins et al., 1989). Wenger's model relied on the interchangeable components: (a) community, (b) identity, (c) practice, (d) meaning, and (e) learning. The current study shows that participants worked together to learn about and develop the tools of the community. This did not happen by chance. The instructor sought to make the lab a cognitive apprenticeship (Cawthon & Harris, 2008), which requires situated learning (Collins et al., 1989). The literature confirmed that situated learning drives cooperation (Stepien & Gallagher, 1993) and such a cooperative and collaborative environment provides the means for the group to form and validate new understanding (Richardson, 2003). The phases provided a meaningful way to began to break down how participants engaged each other and worked to form new knowledge. The examples offered solid evidence of participants cooperating to form understanding.

The Findings and the Literature on the Interaction Analysis Model

The current study's findings fit well with those found by Moore and Marra (2005). For the initial study conducted by Gunawardena et al. (2005), the researchers did not provide a count of phases found in that study, but do indicate finding a majority of phase II and III. Moore and Marra investigated whether social construction of knowledge occurred in their formal, online, asynchronous environment and whether protocols emphasizing disagreement would affect the use of the various phases. Moore and Marra found that in the group without protocols, students used more of the higher phase levels and posted more discussion that could be coded into the phases. The current study was more informal than the usual graduate classroom where students have set discussion questions and response postings. However, all of the phases were present, despite a lack of any direction toward debate or argumentation.

Moore and Marra (2005) found that pushing controversial issues did not facilitate social construction of knowledge and that not pushing controversial issues resulted in higher numbers of phases II-V. The percentage of phases used in the current study is more similar to the findings by Moore and Marra for their group with the constructive argument requirements. Table 6 provides a comparison between all of the studies. In terms of phase use, the current study's findings far exceed those found by Gunawardena et al. (1997) during their second application of the interaction analysis model. However, this study is probably more like that of Gunawardena et al.'s second study and the current study was 24 weeks while Gunawardena et al.'s second study was only three weeks long. In many ways, because that second study by Gunawardena et al. involved a setting

without a facilitator to encourage disagreement, that setting is more similar to the setting of the current study. Gunawardena et al. felt that such an environment was not necessarily conducive to active social construction of knowledge. The current study provided some evidence to the contrary, but more research is needed.

Table 6

Comparison of Percentage of Phase Use between Previous Studies and the Current Study

Study	Phase I	Phase II	Phase III	Phase IV	Phase V
Current Study	56.5%	12.5%	9.5%	3.5%	1%
Moore and Marra (2005)					
w/ protocols	56%	22%	19%	3%	none
No protocols	37%	26%	29%	5%	1%
Gunawardena et al. (1997)					
Second 3-week study	93%	<1%	<1%	<1%	<1%

The Role of the Instructor

In this particular setting, while the instructor fulfilled the role of expert, from which the novice student apprenticed, and principal investigator; the instructor did not

play a distinct role in the social construction of knowledge as evidenced from the postings. Instead, students appeared to participate as equals in the development of understanding. Conversely, the instructor facilitated this role by welcoming, recognizing, and adopting input from the students. For example:

You bring up an intriguing question about how to narrow down the field of schools we ask for mainstreamed students. Two thoughts: 1) I think you are right in that an official 504/IEP team designation is required in all states, not just NY. It could be that state special education offices can help us find out where schools are who serve DHH students. It will not be consistent from state to state who can do this and how this information is available. However, that designation is a place to start. 2) If we focus only on students who receive accommodations/alternate assessments, we will miss those who may participate without either. Do we want to limit this survey to the population of DHH students who have an IEP? This is definitely something we want to clarify before starting a sampling approach. Thanks! (Week 4 Discussions, Winter Term, 2004)

It was often impossible to recognize the instructor's postings from those of the student:

Thanks, RJ. Do we need to ask for permission from the alumni coordinator? Also, do you think it would be good to include information about the research lab itself (admittedly, I haven't read your latest version of your letters yet!). (Week 6 & 7 Discussions, Winter Term, 2004)

The fact that the instructor did not take a greater facilitator role to push disagreement means that this setting may not have been the most conducive for active social construction of knowledge, similar to the second study conducted by Gunawardena et al. (1997).

Summary of the Interpretation of the Findings

Two findings stood out in comparison with the literature on the interaction analysis model, helping to expand understanding of social construction of knowledge and supporting the need for more research. First, the lab was not designed to be a debate type

of environment and the instructor did not specifically instruct students to disagree. However, despite the fact that this setting did not explicitly call for dissonance, a large number of postings were coded for phases II through V. The environment was semiformal in that participants did not necessarily have specific homework type of responses, but were to use the classroom as a place to discuss and develop a research project. The presence of all of the phases provided evidence that social construction of knowledge does occur in this type of environment and that the model is useful for this type of setting, though more research is needed.

The second aspect of the findings that stood out was the evidence that topic rather than time appeared to play a bigger role in the use of phases II through V. The role of time is not well addressed in literature concerning the interaction analysis model and the findings of the current study emphasize the gap in the literature. Time could not be completely ruled out as a variable. Previous studies involved shorter time frames, while this study explored data occurring over 24 weeks. Although, participants did use phases II through V more often in the second quarter; the increase and decrease of phases over the two quarters were similar and coincided with topics requiring more discussion. The number of times a particular phase was used also coincided with the overall number of postings. However, this study appeared to be similar to the type of environment used for Gunawardena et al.'s (1997) second study where the facilitator was not able to encourage or guide disagreement and subsequent synthesis of understanding. So, while time did not seem to play a big role in whether students used certain phases, this is an important area

for more research, especially if the discussions can be more controlled. This finding in the current study demonstrates a continued gap in the literature.

Implications for Social Change

The data supported the self reported knowledge gained by students (Cawthon & Harris, 2008) and provided evidence of the efficacy of online research laboratories that mirror the type experienced by graduate students in a traditional setting (Cotner, Intrator, Kelemen, & Sato, 2000; Gelso, 1993; Hill et al., 2004). Students learned about research together. The data supported the case for knowledge formed socially and for the change in knowledge experienced by individuals.

Additionally, the study demonstrates the role of social construction of knowledge in an asynchronous, online environment, supporting the findings of both Gunawardena et al. (1997) and Moore and Marra (2005). With the upsurge in online education, this study supports the efficacy of online learning, especially in a semiformal environment, which is a very different setting from that of Gunawardena and colleagues or Moore and Marra.

Online learning represents a fast growing industry (Allen & Seaman, 2004). This research added to the understanding of the efficacy of the online learning environment, both generally and in terms of semiformal, long term learning opportunities like online laboratories. Students from all over the United States interacted together to learn about and design a research project. This provides social change implications in that together these students effectively formed new knowledge through sharing of ideas, disagreeing about ideas, and working together to form a common understanding or product. This

study supported the value of online collaboration in learning and provided a foundation for these students to go on to other research activities after participation in the lab and after completing their education goals (Cawthon & Harris, 2008) .

The findings of this study can contribute to the growing body of knowledge about online education and assist institutions in exploring effective programs that reach a growing audience. By learning together, individuals from all over the country to all over the world can come together, learn together, and form a new understanding together. to effect all manner of social change through future research once the student returns to his or her community. While more research is needed, the more we can understand how people learn together, the closer one can come to working together, learning together, and making a difference with social change implications, together.

Recommendations for Action

The results of the study may be useful to researchers and educators in various settings. First, the study is useful to those interested in developing research laboratory opportunities for online programs. Earlier research showed that students reported learning gains. The current study provides evidence for how some of that knowledge gain occurred through social construction efforts. This study provides support for the efficacy of situated learning opportunities, which involve cooperation and opportunity for social construction of knowledge, for online students.

Second, the findings will be useful to educators and course developers of online courses. This study provides another glimpse at the role of social construction of

knowledge in online courses. Understanding how students socially construct knowledge can help course designers and educators implement opportunities for students to disagree and then move through the higher phases in synthesizing new knowledge.

Finally, the findings contribute the growing body of knowledge on social construction of knowledge and will be useful to researchers interested in social interaction and learning in a variety of settings from informal chat rooms and forums to formal debates and online conferences similar to that studied by Gunawardena et al. (1997). This study expands the settings from online forums and formal classrooms, to a semiformal environment without direct guidance towards disagreement. The findings somewhat support Gunawardena et al. in thinking that informal discourse may not facilitate active social construction of knowledge, because there were smaller percentages of phases II through V. However, the data did show that social construction of knowledge occurred opening up possibilities for where social construction of knowledge can occur.

Recommendations for Further Study

The findings from this study revealed a number of areas for further study. More research is needed to explore settings where disagreement is not required. Furthermore, additional studies should explore and control for how formal the setting may be and for time or duration of the learning event under study. Finally, more research is needed to explore the issue of subjectivity and inter-rater reliability as well as the reliability of the model. The following section discusses these areas in greater depth.

Where Disagreement is not Required

Gunawardena et al. (1997) used a debate setting that implied some aspect of disagreement for their first study and then used a forum without an emphasis on debate for the second study. Moore and Marra (2005) provided instructions encouraging students to disagree and debate. The current study was challenging because dissonance or disagreement was not expressly required or inherent in the setting similar to the second study conducted by Gunawardena et al. Except for a couple of postings, most dissonance took the form of implication of a lack of complete agreement. However, phase II was present as well as phases III through V. Time may have been a factor, but Moore and Marra found that more phases were used when they did not provided explicit argumentation instructions. So far, the research is conflicting and more research is needed to see if social construction of knowledge occurs in various contexts where debate is not encouraged.

Formal, Informal and Semiformal Contexts

Furthermore, more studies need to explore the formality of the setting. Moore and Marra (2005) used a formal graduate course as the setting for their study. Gunawardena et al. (1997) used a setting they compared to interaction that might take place during breaks at a formal conference. These settings are widely different. The setting used for the initial study by Gunawardena et al., was more semiformal in that it was a debate with facilitators to guide discussion, but it was not a formal course requiring postings and responses. The current study was semiformal in a different way. Participants had to make

postings, but these postings were not guided. More research is needed to understand the contextual variable and how this interacts with the role of a facilitator who encourages or instructions that guide disagreement. Additional studies would also be useful comparing online and traditional classrooms.

Subjectivity of Coding and Inter-rater Reliability

While inter-rater reliability was achieved after careful discussion and analysis, this study demonstrated the difficulty in achieving consensus for the application of the phases. Moore and Marra (2005) reached 100% inter-rater agreement for all but one week of data for which they achieved 92% agreement. Moore and Marra also recognized the subjectivity of the interaction analysis model. In the beginning of the current study, the inter-rater complained that the interaction analysis model did not seem to fit (S. Getsch, personal communication, June 24, 2008). The difficulty appeared to be agreeing on what postings constituted which phases. After discussion, 95% consensus was achieved. However, the inter-rater continued to feel that the model was inappropriate for the setting (S. Getsch, personal communication, November 14, 2008). It is unknown if this concern on the part of the inter-rater stems from a bias on the part of the principal investigator concerning the efficacy of the model, which will be discussed in greater depth below, or if it is a failure to reach a common understanding of the interaction analysis model. The inter-rater did have her own dissertation to work during the same three month time frame she devoted to this study.

Because consensus was reached for 24% of the study after discussing, it seems likely that 100% consensus would have been reached for all of the data. However, due to the difficulty in readily identifying when a posting constitutes a given phase and due to the challenges of understanding how each other is thinking, future studies should consider striving for 95% inter-rater reliability on 100% of the data. Furthermore, a third inter-rater may be useful to help reduce the subjectivity variable in applying the phases.

Reliability and Phase Definitions

Reliability dictated that the measure is consistent (Trochim & Donnelly, 2007). This study assumed that the interaction analysis model is a reliable measure of the five phases. This assumes that the definition is such that the five phases can be applied consistently. It is difficult to say whether the challenges discussed above were due to reliability of the measure, inter-rater reliability or a combination of these issues. Given that Moore and Marra (2005) had some inter-rater issues, reaching only 92% consensus, more research should be done simply investigate the reliability issue and to discern if the definitions require some expansion based on the setting.

Time as a Factor

Time did not appear to play an obvious role. Instead, it appeared that it was more often the topic and the group work toward the construction of a product or idea that fostered the use of more phases. Therefore, a one quarter class would not preclude the use of higher phases. Additional research to explore the time factor would be very useful,

especially if the other variables, requirement for disagreement and setting, can somehow be controlled. Research would be needed on both long term environments and single quarter or semester courses. Additionally studies where the topic of discussion variable could be controlled would also be useful.

Quantitative Studies

Discourse analysis is a challenging form of research to approach from a quantitative methodology (Antaki, Billig, Edwards, & Potter, n.d.). However, once all of the variables are better understood, a quantitative study might be useful. Such a study might explore correlations between variables. Additionally, perhaps in time, a quasi-experimental design (Creswell, 2003) might be useful to explore techniques for stimulating phase use as compared to a control group. A quasi-experimental design might also be useful to explore the variable of time as long as the variable of topic could be controlled. The key to conducting quantitative studies will be the ability to control the variables (Creswell) which is going to require a thorough understanding of the interaction analysis model (Gunawardena et al., 1997) and the setting.

Researcher's Bias

Because the lab that forms the setting for this study occurred almost four years before the data coding, the principal investigator found it difficult to recognize her own postings or remember postings from the lab. Where the principal investigator's participation in the lab helped coding was in certain cases where she knew to what a

posting referred while a person not familiar with the lab might have been confused by the lack of threading as discussed in chapter 4.

The principal investigator recognized her bias to think of the study as a successful learning experience, both from her own time in the lab and the results of earlier studies (Cawthon & Harris, 2008). However, this bias did not extend to the expectation of phases. While social construction of learning was expected, it was surprising how many phases 3 through 5 were found. The expectation was for less of these phases because there was no specific requirement for disagreement and the literature showed that these phases are less common (Gunawardena et al., 1997; Moore & Marra, 2007). The inter-rater did not feel the model fit the setting (S. Getsch, personal communication, November 14, 2008). It is difficult to say whether the principal investigator was biased toward the interaction analysis model, either because she selected it for the study or because she felt that social construction of knowledge occurred; or if the principal investigator is biased because she had more time with the material, several years versus three months, so she saw the fit better. Since 95% agreement was reached, the current study supports the efficacy of the interaction analysis model. However, more research using the model in a variety of settings may help to discern if more training or knowledge is needed by the inter-rater or if more inter-raters are needed or if the model definitions require adjustment for different settings.

Inter-rater Bias

The inter-rater did participate in the lab. However, she did not join the lab until the third quarter. Neither this nor the subsequent quarters were included in the data analysis. The inter-rater did have knowledge of the lab, which may have helped to understand how postings were connected.

Take Home Message

The most important message that emerged from this study is that individuals do socially construct knowledge and they can do so in an online, semiformal, long term asynchronous learning environment. Sharing of information, disagreeing with information, modifying thinking, and testing thinking all take place though it may be subtle at times and the various phases may blend together in longer, thoughtful posts. Participants construct knowledge through the use of different phases even when there is no explicit push to do so. More research is needed to understand the variables of time, requirements for disagreement, formality of setting, topic of discussion and reliability. However, this study helps to realize the potential for social construction of knowledge in a semiformal to formal class if the right environment is fostered.

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APPENDIX A:

INTER-RATER TRAINING

A) Approval of Dissertation Proposal

B) Provide the following reading material to the individual selected to provide inter-rater reliability

1) Gunawardena, C. N., Lowe, C. A., & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research*, 17, 397-431.

i) This document provides a description of how Gunawardena et al. (1997) developed the interaction analysis model and a in depth look at the model. This paper also provides results for the use of the model in a study evaluating interaction of graduate students during a pre-conference debate.

ii) The goal is to allow the inter-rater to understand the foundation and application of the interaction analysis model. This paper was used by the principal investigator in forming her understanding of the model.

2) Moore, J. L. & Marra, R. M. (2005). A comparative analysis of online discussion participation protocols. *Journal of Research on Technology in Education*, 38, 191-212.

i) This document provides a description of an independent research project using the interaction analysis model.

- ii) The goal is to build on the foundation of the first document by permitting the inter-rater to see the model in action in another setting

C) The principal investigator will code one sixth of the first quarter (two of 12 weeks) and use this material to explain the coding process.

1) Description of the Dataset:

- i) This data represents discussion board and chat room data comprised of all the postings made by participants in the lab during the relevant quarter. The goal is to analyze these two forms of communication in terms of the interaction analysis model. This data has been broken into units of analysis representing single posts (either for discussion board data or chat room data). The units of analysis for chat room data will be considerably smaller than those used for the discussion board.

2) Examples, if applicable, of multiple codes per unit of analysis:

- i) A single post may address a number of different questions and comments by other users and may represent different parts of the interaction analysis model.

3) Process of coding

- i) Our first goal is to code the same data set and come to a 95% agreement. The data has been divided into units and placed in an MS Excel file. The first column represents the units of analysis. Each unit, a single posting, representing a single line in that column and will be evaluated for the five phases. Five blank columns are to the right. The first column should have a "1" if the first phase is present. The second column should have a "1" if the

the second phase is present. The third column should have a "1" if the third phase is present. The fourth column should have a "1" if the fourth phase is present. The fifth column should have a "1" if the fifth phase is present. Each line is evaluated independently. As discussed a line, or single unit of analysis, may have multiple phases/columns marked with a "1."

- ii) We will compare two week increments until we reach 95% agreement. If you have difficulty coding a posting, make comments in the sixth column to the right and we will discuss these issues when we get together by telephone in one week.
 - iii) Once we reach agreement, an MS Excel file with the units of analysis already broken out exactly as described above for Quarter Three will be provided. The first tab will have the discussion board data and the second tab will have chat room data.
 - iv) When complete the data will be returned to the principal investigator by email and used for data analysis.
- 4) The inter-rater and the principal investigator will code two more weeks and compare.
- D) The inter-rater and the principal investigator will discuss disagreement and refine.
- 1) If someone has questions about coding a data unit, this should be brought to the next discussion.
- E) The inter-rater and the principal investigator will continue to code two week elements until 95% agreement can be reached, but not to exceed the first quarter.

- F) Once agreement has been reached, the following will be coded independently by the principal investigator and the inter-rater
- 1) Quarter One remaining weeks and any additional chats: Inter-rater
 - 2) Quarters Two and Four (including chats): Principal Investigator
 - 3) Quarter Three (including chats): Inter-rater

CURRICULUM VITAE

Alycia L. Harris
alycia.harris@gmail.com

Education

- 2009 PhD Student., General Psychology, Research and Evaluation Track
Walden University, Minneapolis, MN.
PhD Dissertation: *Social Construction of Knowledge in an Online, Long-term, Semiformal, Learning Environment.*
Adviser: Stephanie Cawthon, Ph.D.
- 2006 M.S., General Psychology
Walden University, Minneapolis, MN.
Masters Thesis: *An Examination of Cognitive Apprenticeship as a Model for Online Research Training Environments.*
Adviser: Stephanie Cawthon, Ph.D.
- 2005 Distance Learning Certificate Program
University of West Georgia, Carrollton, GA.
- 2000 B.S., Individualized Studies
Charter Oak State College, New Britain, CT.
Conferred with Honors

Other Education

- 2009 Global Terrorism Course
Peace Operations Training Institute
- 2007 3rd Annual PSLC LearnLab Summer School
Carnegie Mellon University, Pittsburgh, PA

Project: Personalization in Learning Research Proposal
- 2007 Teaching at a Distance: From Concept to Practice Workshop
Dr. Joe Levine, Learner Associates
- 2005 International Programs Security Requirements Course

DoD Defense Institute of Security Assistance Management

Experience

2007 - Present	Volunteer, Huntsville Museum of Art
2006	Teaching Assistant to Dr. Stephanie Cawthon
2005 - 2007	Research Assistant to Dr. Stephanie Cawthon
2004 - 2005	Research Laboratory Member

Other Experience

2005 - Present	ITT Corporation, AES, Huntsville, AL
2001 - 2004	CG ² , Inc. A Quantum3D Co., Huntsville, AL
1997 - 2001	Boeing
1994 - 1997	Subcontractor to Rockwell International (now Boeing)
1992 - 1993	US Army
1989 - 1992	California Department of Forestry and Fire Protection

Publications

Cawthon, S. & Harris, A. (2008). Developing a community of practice: The role of sociology in learning and team development. In Orvis, K. & Lassiter, A. (Eds). *Computer Supported Collaborative Learning: Best Practices and Principles for Instructors*. Hershey, PA: Idea Group Publishing.

Cawthon, S., Harris, A. & Jones, R. (under review). *Online Research Lab for graduate students in psychology*.

Harris, A., Cawthon, S., & Jones, R. (2005, November). The Use of the Asynchronous Learning Environment as a Cognitive Apprenticeship Tool for Adult Learners. *Proceedings for the Annual Conference for the American Association of Adult and Continuing Education*, Pittsburg, PA.

Presentations

Harris, A. & Cawthon, S. (2008, March). Secondary Discourse Analysis of Social Construction of Knowledge in an Online Asynchronous Graduate Research Setting. Poster presentation for the annual meeting of the American Education Research Association, New York, NY.

Cawthon, S., Harris, A. & Jones, R. (2006, May). Student Perception of Connectedness Related to Learning Outcomes in Online Research Laboratory. Poster presentation for the annual meeting of the Association for Psychological Science, New York, NY.

Cawthon, S & Harris, A. (2005, August). Integrating research training into an online graduate program in psychology. Poster presented at the annual convention of the American Psychological Association, Washington, DC.

Memberships

American Education Research Association
Psi Chi National Honor Society
Toastmasters International
 Past Division Governor
 Past Area Governor
Museum Education Roundtable
The American Association for Adult and Continuing Education
Society for the Teaching of Psychology
American Psychological Association
American Psychological Society
American Society for Training and Development
National Classification Management Society
 Education and Training Committee
 Government and Industry Committee
 ISP Committee
OPSEC Professional Society
ASIS International